THE IMPACT OF PHYSICIAN SUPPLY AND REGULATION ON PHYSICIAN FEES AND UTILIZATION OF SERVICES

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The rapid escalation in physician services expenditures in the last 15 years no longer needs documentation. In 1965, the U.S. spent $8.5 billion on physician services alone; by 1982, this number had increased more than seven-fold to $61.8 billion a compound rate of growth of 11.7 percent (Gibson, et al., 1983). The federal share of this outlay has been growing as well, from 15 percent of physician expenditures in 1970 to 22 percent in 1982. One out of every five dollars spent on physicians' services is being spent by the federal government through Medicare and Medicaid.

While the major part of this increase can be attributed to population growth and inflation in the economy as a whole, these factors account for only two-thirds of the growth in physician expenditures over the last decade (Freeland and Schendler, 1983). Another part of the additional dollars were accounted for by physician fee increases above and beyond general price inflation. Even so, over one-quarter of the growth in expenditures (27.4%) remains "unexplained", but is usually ascribed to service intensity, e.g., more surgeries per hospital stay, more lab tests, longer visits, etc.

Policy makers are actively pursuing a number of ways of controlling expenditures, including physician fee caps, higher out-of-pocket deductibles and copays, and packaging services into one payment (e.g., HMOs, PPOs, physician DRGs). It is now generally accepted that controlling the health care budget requires changing the underlying incentive structure of physicians, to discourage marginal use rather than promoting it, to encourage fee competition, and to encourage physicians to substitute less expensive for more expensive modes of care.

In so doing, two critical behavioral questions must be answered:

- What impact does more extensive insurance coverage have on physicians' services and fees?
- Do physicians have any significant market power to "shift" demand?

Goals and Purposes of the Study

Concerned about how competition affects physicians' fees and utilization decisions, we designed a study to address, in depth, these two behavioral questions, viz., the impact of insurance on utilization and fees and the existence of physician demand inducement.

While many other studies have addressed these issues, ours was unique in several respects. First, in our conceptual work, we developed a model of price inducement with downward price rigidity due to Usual, Customary, and Reasonable (UCR) reimbursement methods that key on stated charges. Treating inducement as a form of "advertising", we developed a dynamic, lagged adjustment process by which markets eventually clear after short run inducements occur. Second, by concentrating on a heavily insured Blue Shield and Medicare population, we were able to control for insurance coverage better than most studies, giving a more accurate estimate of inducement effects, if any. Third, by concentrating on one state (Michigan), we were able to obtain very detailed patient migration-for-care data, permitting a far better measure of physician market areas. And fourth, we were able to conduct detailed Medicare beneficiary-specific analyses of three tracer conditions, thus controlling for variations in health status to a greater degree than heretofore.

Overview of Data Bases and Methods

The Blue Cross-Blue Shield of Michigan claims files provided the basic data for this study. These files were supplemented by a physician mail survey and secondary data to measure the nature and extent of amenities, competition, and the like.

Analyses were carried out from three perspectives: the market area, the physician, and the Medicare beneficiary. Although each has its strengths and weaknesses, they complement one another in important ways. For example, utilization analysis at the physician level allowed us to measure use rate per patient per physician while the beneficiary analysis allowed us to sum utilization across both primary and consulting physicians to capture referral effects. Analysis at the broad market level, properly adjusted for patient bordercrossing for care, permitted direct fee and utilization comparisons across areas with differing insurance coverage and degree of physician competition.

Descriptive and econometric work was carried out over the 1975-80 period on 15 market areas, several thousand physicians stratified by specialty, and 5-15,000 Medicare beneficiaries in the three tracers. Average charges per RVU, RVUs per patient or beneficiary, and total charges per effective population[1] and per beneficiary were displayed, stratified by insurance coverage, per capita income, and physician supply. Utilization statistics were further decomposed into medical, surgical, and obstetrics/gynecology services as well as by inpatient, office, and ancillary testing.

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[1] An area's effective population is its actual population adjusted for in-and-out migration for care.

Findings and Policy Implications

The findings of our detailed micro-investigation of one large state have important implications for public policy more broadly. First, all of our work confirms the hypothesis that geographic disparities in the level and growth of physician services and not fees provide a major impetus to physician expenditure growth. This is particularly true when fees are adjusted by economy-wide inflation. Thus, while direct fee controls (or indirect constraints like the Medicare Economic Index) can slow expenditure inflation, broader measures are .necessary to deal with (possibly) inappropriate utilization.

Two approaches to excess utilization are gaining popularity. In the first, Medicare beneficiaries join an HMO where total annual charges are fixed, or capitated. The HMO staff become the gatekeepers to the medical care system, restricting unnecessary utilization case-by-case. In the other approach, several physician procedures are packaged into a single fee, with no additional payment for any individual procedure within the package. One package could include routine ancillaries along with an office visit. Another could lump all inpatient routine ancillaries along with an office visit. Another could lump all inpatient physician services into one payment to the attending physician (so-called physician DRGs) who would be financially discouraged from recommending unnecessary consults, x-rays, lab tests, etc. These appear to be exactly the services varying the most across areas according to our analysis.

Second, our findings about the extent of bordercrossing point to a technical problem in calculating what Medicare HMOs ought to be paid. Currently, Medicare uses the Adjusted Average Per Capita Cost (AAPCC) of Medicare fee-for-service beneficiaries in a market area as a payment level. When calculated on a small area basis, however, the AAPCCs freeze in large interarea differences in utilization patterns. The result is high AAPCCs in, say, Detroit, and potentially much lower ones elsewhere in the state. The practice of deducting any prior HMO experience in the calculations further exacerbates the disparities where selection bias exists. HCFA attempts to adjust for this bias in calculating AAPCCs, but the interarea utilization differences are not addressed.

Large geographic differences in utilization rates make HCFA's definition of an HMO market area a crucial one -- particularly given their popularity in high use urban areas.

As for the relationship between physician supplies and expenditures, if our findings are correct that availability alone generates more use, then it may be somewhat academic whether physicians cnsciously shift demand, unconsciously follow established practice patterns that raise utilization, or are simply more readily available to patients. If all three are at work, then the problem is admittedly worse, but even if it is just an access question, larger Medicare expenditures are the result. Nor is this to downplay the problem of

insurance coverage and the associated moral hazard. On the contrary, our results show a fairly strong insurance effect on utilization. We simply point out that more physician competition does not necessarily save money *in toto* under a fee-for-service reimbursement system. Being able to bill for each ancillary procedure separately appears to add significantly to Part B outlays, arguing for capitation or packaging of these services.

Greater physician supply, however, can be used to advantage, even though it provides no panacea by itself. As more physicians are left to divide a relatively fixed caseload (intensity per case is more variable), individual caseloads fall. This should make physicians as a whole amenable to some form of managed care, i.e., HMOs, IPAs, PPOs. And under fixed payment, they should be less likely to recommend marginal care.

Chapter 1

STATEMENT OF THE PROBLEM

Introduction

1.1 Policy Issues

The rapid escalation in physician services expenditures in the last 15 years no longer needs documentation. In 1965, the U.S. spent $8.5 billion on physician services alone; by 1982, this number had increased more than seven-fold to $61.8 billion, a compound rate of growth of 11.7 percent (Gibson, et al., 1983). The federal share of this outlay has been growing as well, from 15 percent of physician expenditures in 1970 to 22 percent in 1982. One out of every five dollars spent on physicians' services is being spent by the federal government through Medicare and Medicaid.

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Policy makers are actively pursuing a number of ways of controlling expenditures, including physician fee caps, higher out-of-pocket deductibles and copays, and packaging services into one payment (e.g., HMOs, PPOs, physician DRGs). It is now generally accepted that controlling the health care budget requires changing the underlying incentive structure of physicians, to discourage marginal use rather than promoting it, to encourage fee competition, and to encourage physicians to substitute less expensive for more expensive modes of care.

In so doing, two critical behavioral questions must be answered:

- o What impact does more extensive insurance coverage have on physicians' services and fees?
- o Do physicians have any significant market power to "shift" demand?

Unnecessary utilization results in greater public and private outlays regardless of the source. If broad differences in utilization rates exist between heavily insured and less fortunate groups, it is cause for

concern. If physicians can raise utilization even further than low net (i.e., insured) prices would indicate, this is particularly alarming, as it erodes the base upon which both competitive and regulatory approaches rest.

Answers to these questions are critical, as different problems require different solutions. If physicians lack inducement capabilities and insurance is the single driving force behind high fees and utilization, then either raising out-of-pocket prices, introducing more competition, or constraining allowables will all produce the desired results of lower outlays (with some important side-effects). With inducement, however, slippage occurs and net effects of new policies are reduced if not eliminated altogether.

It is also important to keep in mind that the major expenditure problem with the physician sector is not exorbitant increases in fees but rapid utilization growth. Simple competitive solutions like expanding physician supply will not solve this problem although it may lower average fees. Greater supply, however, while not the solution *in vacuo*, can be used to leverage public policies aimed at increasing competition. Where physicians are plentiful, HMOs, PPOs, and higher out-of-pocket payments can encourage adequate numbers of physicians to participate in public programs in ways that avoid inappropriate utilization.

1.2 Goals and Purposes of the Study

Motivated by the need to know more about how competition affects physicians' fee and utilization decisions, we designed a study to address, in depth, the first two behavioral questions, *viz*., the impact of insurance on utilization and fees and the existence of inducement potential. More specifically, we were interested in showing differences in fee and utilization rates across areas which differed in insurance coverage and the degree of physician competition.

While many other studies have also pursued these goals, ours was unique in several respects. First, in our conceptual work, we developed a model of price inducement with downward price rigidity due to Usual, Customary, and Reasonable (UCR) reimbursement methods that key on stated charges. Treating inducement as a form of "advertising", we go on to develop a dynamic, lagged adjustment process by which markets eventually clear after short run inducements occur. Second, by concentrating on a heavily insured, Blue Shield and Medicare population, we were able to control for insurance coverage better than most studies, giving a more accurate estimate of inducement effects, if any. Third, by concentrating on one state (Michigan), we were able to obtain very detailed patient migration-for-care data, permitting a far better measure of physician market areas. And fourth, we were able to conduct detailed Medicare beneficiary-specific analyses of three tracer conditions, thus controlling for variations in health status to a greater degree than heretofore.

1.3 Overview of Data Bases and Methods

The Blue Cross-Blue Shield of Michigan claims files provided the basic data for this study. These files were supplemented by a physician mail survey and secondary data to measure the nature and extent of amenities, competition, and the like.

Four types of analyses were conducted:

(1) An Aggregate Market Study of 15 physician market areas over the 1975-80 period on Blue Shield subscribers only;

(2) A Micro-Physician Study of the fee and utilization profiles of several thousand physicians over the 1975-80 period;

(3) An Aggregate Medicare Study of physician fees, utilization, and assignment rates across 15 market areas for 1975-80; and

(4) A Medicare Tracer Study of physician charges and utilization in 15 market areas for the single year, 1980, using the beneficiary as the unit of analysis.

Analyses were carried out from three perspectives: the market area, the physician, and the Medicare beneficiary. Although each has its strengths and weaknesses, they complement one another in important ways. For example, utilization analysis at the physician level allowed us to measure use rate per patient per physician while the beneficiary analysis allowed us to sum utilization across both primary and consulting physicians to capture referral effects. Analysis at the broad market level, properly adjusted for patient bordercrossing for care, permitted direct fee and utilization comparisons across areas with differing insurance coverage and degree of physician competition.

Several million claims were processed into analytic files supportive of the four studies, based on the analytic unit. Besides the standard charge and utilization information, Michigan is one of the few carriers with excellent diagnostic information on the Part B Medicare claims, the *sine qua non* of tracer studies. Both physician survey and secondary data were then merged onto the analytic claim files, cleaned and edited, and finally available for the analysis. The reader is referred to Chapter Three for details on our data base and methods.

Before conducting rigorous tests of the research hypotheses, several technical problems had to be overcome. Chief among these were (a) the extensive interarea migration of patients for care, (b) the large disparities in cost-of-living, (c) the construction of output-adjusted fee and utilization indices, and (d) the choice and construction of three diagnostic tracer conditions.

First, using physician claims information on patient place of residence versus place of care, detailed migration maps were produced for Michigan's 83 counties. These maps were then statistically analyzed

to produce 15 aggregate market areas that minimized interarea bordercrossing (see Figure 1-1). In the statistical work that follows, each market area is referred to by its central place, e.g., Pontiac, or primary SMSA, or occasionally the county in which the central place is located, e.g., Pontiac is in Oakland County, which is market area 11 in Figure 1-1. Oakland is the only market area comprising a single county, while Detroit, in Wayne County, is a two-county market area. By contrast, practically the entire Upper Peninsula comprises the Marquette market area (13 counties) while the Emmett, Grand Traverse, and Kent market areas each have at least ten counties. The claims data show extensive patient travel for office care in these areas relative to, say, the Oakland or Wayne areas. Significant bordercrossing remains after aggregation in any event, necessitating a further adjustment to areawide population figures which controlled for net immigration.

Second, a Michigan county-specific cost-of-living index was produced based on a regression using census data. The index was then used to deflate nominal charge and payment data, putting fees on a comparable basis across market areas.

Third, to develop average fee and utilization statistics that would be comparable across physicians and market areas, 424 separate procedures were used to develop a Relative Value Unit (RVU) index. The index was based on relative charges per service, with a routine office visit as the numeraire. Surgeries costing 20 times an office visit, for example, would be weighted 20 times more heavily in the index. Dividing through GPs' and surgeons' total charges by their indexed output therefore provides a more meaningful estimate of unit charge differences.

Finally, an extensive literature review was conducted to select three tracer conditions (diabetes, hypertension, and urinary tract infection) for special study. Then any Medicare beneficiary in Michigan with at least one of these conditions showing on any Part B claim during the year, 1980, was put into one of the three tracer files. To further control for health status <u>within</u> each tracer, a health status index was constructed, based on a regression of total charges on a list of secondary diagnoses, age, and sex. Each patient's diagnostic and personal characteristics were weighted by the estimated regression coefficients, producing an expected total charge figure. This figure, in turn, was used as a deflator of beneficiaries' actual charges. For instance, if a patient's expected charges were 10 percent above the state average due to complicating conditions, his or her actual annual charges would be divided by 1.10 to make them severity-constant. If adjusted charges remained above average, other factors beside illness severity must be responsible.

Figure 1-1

CONFIGURATION OF MICHIGAN'S
15 MARKET AREAS

Descriptive and econometric work was carried out on the 15 market areas, several thousand physicians stratified by specialty, and 5-15,000 Medicare beneficiaries in the three tracers. Average charges per RVU, RVUs per patient or beneficiary, and total charges per effective[1] population and per beneficiary were displayed, stratified by insurance coverage, per capita income, and physician supply. Utilization statistics were further decomposed into medical, surgical, and obstetrics/gynecology services as well as by inpatient, office, and ancillary testing.

1.4 Summary of Findings

Figures 1-2A and 1-2B show the variation in real charges per RVU and total RVUs per 1,000 effective Blue Shield population across 15 market areas in Michigan. These data clearly indicate that interarea physician expenditure variation per capita is primarily due to utilization differences and not prices (once deflated for cost-of-living). Total RVUs per capita in Pontiac were over 2 1/2 times the rate in the Marquette (Upper Peninsula) market area -- even after adjusting for bordercrossing. Real charges per RVU, by contrast, were only $0.50 higher in Marquette (or slightly over 5%).

Table 1-1 provides a more detailed picture of the geographic differences in utilization by service, this time for Medicare beneficiaries with diabetes. (All dollar figures have been deflated by both cost-of-living and our interarea health status index.) As in Figure 1-2B, the interarea variation in expenditures is large, although not nearly as much as for Blue Shield subscribers. Medicare beneficiaries in Pontiac incurred charges only about 33% greater than in Marquette, but this is cost-of-living adjusted for a very narrowly defined illness (and excludes all health beneficiaries without diabetes).

What is more interesting is the source of expenditure variation. Actual hospital inpatient physician charges in Pontiac and Marquette are identical ($361 - $362), which typifies the lack of variation from this source. What, then, explains the $240 difference in total charges? Lab tests alone explain $100 of the discrepancy, with Pontiac beneficiaries incurring nearly 3 times the cost. Special studies contribute $54 to the difference, and x-rays another $32. All three ancillary services together explain $186 of the $240 difference, or nearly 80%. Office visit charges contribute another $47 while consults add $16. The other two tracers showed very similar patterns.

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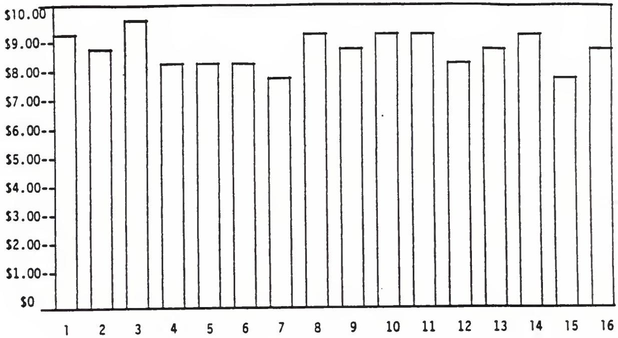
[1] By "effective" is meant the actual area population adjusted for in-and-out migration for care.

REAL CHARGE PER RVU
Figure 1-2A



TOTAL RVUS PER 1000 EFFECTIVE POPULATION
Figure 1-2B

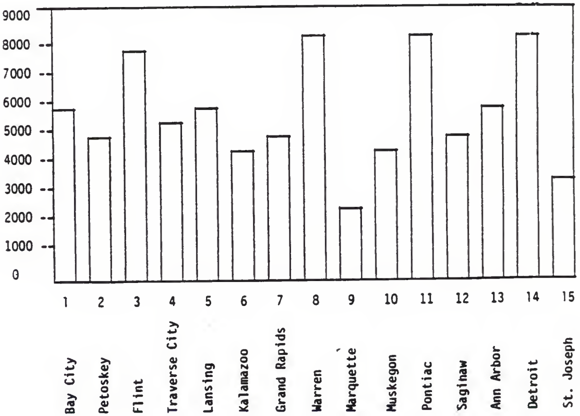


Table 1-1

1980 MEDICARE ANCILLARY SERVICE CHARGES PER BENEFICIARY ADJUSTED FOR COST-OF-LIVING AND HEALTH STATUS BY MARKET AREA: DIABETES

MARKET AREA	TOTAL*	INPATIENT	X-RAY	NURSING HOME	SPECIAL STUDIES	LAB.	CONSULT	OFC.	MISC.
Oakland (Pontiac)	$934	$361	$82	$33	$72	$147	$35	$122	$ 81
Grand Traverse (Traverse City)	547	274	43	9	21	66	16	72	46
Ingham (Lansing)	585	283	54	18	42	51	17	67	52
Washtenaw (Ann Arbor)	634	314	62	19	32	60	22	77	49
Wayne (Detroit)	866	358	85	28	66	129	32	102	66
Muskegon (Muskegon)	663	371	55	13	21	40	21	87	54
Kalamazoo (Kalamazoo)	670	327	74	18	24	47	20	82	79
Genesee (Flint)	765	308	78	15	70	108	24	77	84
Emmett (Petoskey)	528	291	40	13	23	48	17	68	28
Berrien (St. Joseph)	515	283	48	10	15	29	13	73	43
Kent (Grand Rapids)	662	353	58	17	26	55	19	64	69
Saginaw (Saginaw)	663	300	49	16	38	87	17	68	88
Macomb (Mt. Clemens)	795	319	80	18	71	129	26	90	62
Marquette (Marquette)	694	362	50	22	18	47	19	75	100
Bay (Bay City)	649	342	46	9	48	78	31	51	47

* Total charges may not equal sum of ancillary charges due to rouding. Total charges taken from Column 3, Table 7-2

Not only do utilization differences explain most of the geographic variation in expenditures, they also are the driving force behind real expenditure growth as well.

- o While Blue Shield fees per RVU did grow 59% between 1975-80, real (inflation-adjusted) fees grew only 8%.
- o On the other hand, real physician utilization per capita grew 31-46% in just 5 years across 15 market areas.

What causes such inequalities in use rates? If we simply stratify the market areas by the number of physicians per effective population (MDEPOP), we find that

- o high MDEPOP areas exhibited per capita Blue Shield utilization rates 31% greater than in low MDEPOP areas; and
- o high MDEPOP areas also showed the highest rates of utilization growth, exacerbating inequalities across market areas.

Even more remarkable, however, is the correlation between utilization patterns and insurance coverage.

- o Utilization per Blue Shield subscriber was 84% higher in the areas with the highest BCBSM insurance penetration vs. low-penetration areas.

Because BCBSM coverage provisions are actually quite similar across market areas within Michigan, these disparities must be interpreted as the result of systematic differences in practice patterns for all physicians resulting from nearly free medical care.[2] If subscribers face similar out-of-pocket prices but show very different utilization patterns across market areas, this must reflect widespread differences in practice styles due to insurance generally and not to the coverage of any subgroup like Blue Shield in particular.

Using regression analysis, we attempted to isolate the insurance and the physician supply effects in the aggregate market area, physician, and beneficiary tracer data. While the results are somewhat mixed on inducement, we do find that

- o in the market area comparisons, the physician-per capita (MDPOP) utilization elasticity was .2-.3, <u>ceteris paribus</u>, the lower number resulting from an adjustment for bordercrossing;
- o no MDPOP elasticity on real physician fees; and
- o a rapid speed of adjustment to an equilibrium fee due to competition.

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[2] For BCBSM subscribers alone, only 1.3% of total physician charges were paid for out-of-pocket, an extremely low percentage even for an insured population.

At the physician level, little or no inducement effect is discovered, possibly because the patient's utilization is "broken up" across more physicians where they are plentiful.

In the tracer work, however,

- o the number of primary care physicians per effective population (PCEPOP) was positively related to use in all three tracers for total real Medicare charges per beneficiary, as well as for x-rays, lab tests, and special studies; and

- o PCEPOP was positively related to per beneficiary specialist consultations.

Based on tracer regression coefficients,

- o areas with PCEPOP ratios one standard deviation above average had total real Medicare charges per diabetic beneficiary \$65 more than average (or 9% more), \$111 more for hypertension (17% more), and \$165 more for urinary tract infection (18% more).

Surprisingly,

- o the number of other physicians per effective population (OMDEPOP) often showed negative effects on total charges, partially offsetting the positive primary care effects.

However,

- o all of the negative OMDEPOP effect came in depressing fees, not utilization.

Hence,

- o the net effect of greater physician supply, holding insurance, health status, and other factors constant, is to significantly increase utilization and charges per capita and per Medicare beneficiary.

A significant drawback of the tracer findings is that they are based on a single year's data. This should not affect the basic market area statistics which are based on thousands of individuals, but it does preclude any estimation of the dynamic adjustment process. Of particular concern is the endogeneity of physicians' decisions to locate in heavily insured areas. In the micro-physician regressions positive Blue Shield utilization effects due to physician supply disappeared once physician location was predicted in a prior equation.

If physician availability determines utilization in a positive way, and if physicians naturally locate disportionately in heavily insured areas, then a simple inducement test is biased in favor of a finding that really

applies more to insurance. Reallocating physicians across markets, holding insurance coverage constant, would tend to even out utilization but not necessarily reduce it. Raising out-of-pocket costs everywhere, however, is more likely to have the desired effect of lowering utilization.

1.5 Conclusions and Policy Implications

The findings of our detailed micro-investigation of one large state have important implications for public policy more broadly. First, all of our work confirms the hypothesis that geographic disparities in the level of physician services and intertemporal growth in these services provide a major impetus to general expenditure growth. This is particularly true when fees are adjusted by economy-wide inflation. Thus, while direct fee controls (or indirect constraints like the Medicare Economic Index) can slow expenditure inflation, broader measures are necessary to deal with (possibly) inappropriate utilization.

Medicare carriers under the existing system are quite limited in what they can do in this regard because of the millions of individual claims processed each year. It would be an extraordinary effort to identify, then disallow, marginally useful care. Carriers have enough of a job identifying clearly uncovered services. Given the flexibility physicians have to bill under many similar procedure codes, the only feasible way of controlling utilization is through a decentralized incentive structure that encouraged each physician and patient to use less.

Two approaches to excess utilization are gaining popularity. In the first, Medicare beneficiaries join an HMO where total annual charges are fixed, or capitated. The HMO staff become the gatekeepers to the medical care system, restricting unnecessary utilization case-by-case. In the other approach, several physician procedures are packaged into a single fee, with no additional payment for any individual procedure within the package. One package could include routine ancillaries along with an office visit. Another could lump all inpatient physician services into one payment to the attending physician (so-called physician DRGs) who would be financially discouraged from recommending unnecessary consults, x-rays, lab tests, etc. These appear to be exactly the services varying the most across areas.

Second, our findings about the extent of bordercrossing point to a technical problem in calculating what Medicare HMOs ought to be paid. Currently, Medicare uses the Adjusted Average Per Capita Cost (AAPCC) of Medicare fee-for-service beneficiaries in a market area, usually one or more counties, as a payment level. When calculated on a small area basis, however, the AAPCCs freeze in large interarea differences in utilization patterns. The result is high AAPCCs in, say, Detroit, and potentially much lower ones elsewhere in the state. The practice of deducting any prior HMO experience in the area further exacerbates the disparities where selection bias exists. HCFA attempts to adjust for this bias in calculating AAPCCs, but the interarea differences are not addressed.

Of course, long run behavior under HMOs should lower utilization, but only for HMO enrollees. Unless the lower HMO utilization experience is figured into the rates, few benefits of recalibration are derived. Recent modifications in the HMO contract to "plow back" extraordinary savings into more service benefits would seem to be counterproductive. In any event, large geographic differences in utilization rates make HCFA's definition of an HMO market area a crucial one -- particularly given their popularity in high use urban areas.

As for the relationship between physician supplies and expenditures, if our findings are correct that availability alone generates more use, then it may be somewhat academic whether physicians consciously shift demand, unconsciously follow established practice patterns that raise utilization, or are simply more readily available to patients. If all three are at work, then the problem is admittedly worse, but even if it is just an access question, larger Medicare expenditures are the result. Nor is this to downplay the problem of insurance coverage and the associated moral hazard. On the contrary, our results show a fairly strong insurance effect on utilization. We simply point out that more physician competition does not necessarily save money <u>in toto</u> under a fee-for-service reimbursement system. Being able to bill for each ancillary procedure separately appears to add significantly to Part B outlays, arguing for capitation or packaging of these services.

Greater physician supply, however, can be used to advantage, even though it provides no panacea by itself. As more physicians are left to divide a relatively fixed caseload (intensity per case is more variable), individual caseloads fall. This should make physicians as a whole more amenable to some form of managed care, i.e., HMOs, IPAs, PPOs. And under fixed payment, they should be less likely to recommend marginal care. The physician is faced with a choice of raising fees or intensity on his/her remaining patients versus joining an alternative delivery system that assures an adequate caseload. For many, the later choice may involve less hassle and risk, although practitioners will hold different opinions as well as facing different demands for their services. Where physicians are plentiful, as in the tri-county Oakland, Wayne, and Macomb area in Michigan, HMOs and PPOs could be appealing to physicians if beneficiaries enjoy strong incentives to leave fee-for-service medicine.

1.6 Overview of the Report

The rest of the report is in six chapters plus appendices. Chapter 2 provides a lengthy discussion of alternative models of physician fee setting and utilization, with special emphasis on price rigidities and lagged market clearing behavior. The chapter concludes with a general specification of the demand and supply equations to be estimated and how they would be interpreted as regards insurance vs. inducement effects.

Chapter 3 then presents a discussion of all data bases and methods, the content of the claims files, how 424 procedures were standardized to an RVU index, how bordercrossing results in 15 market areas, how we generated a micro-area cost-of-living index, and the nature of our unique physician survey.

Chapter 4 begins reporting the empirical findings, first, for the aggregate market study of Blue Shield subscribers. Nominal vs. real fees per RVU are displayed by market basket, followed by RVU utilization statistics, all by market area. The chapter concludes with a set of regression results based on 15 areas for the 1975-80 period.

Chapter 5 turns to Blue Shield individual physician analysis. Corresponding descriptive and econometric results are presented by specialty group, for both fees and utilization.

Chapter 6 provides an introduction to the Medicare work by showing fees and beneficiary utilization for all enrollees by market area. Assignment rates are also presented by market area.

Chapter 7 continues the Medicare work but in a different vein. A detailed discussion of three diagnostic tracers is provided, followed by descriptive and econometric analysis of 5-15,000 Medicare beneficiaries by tracer. All descriptive analyses of fees and utilization are shown by market area within tracer. The econometric work explains real charges per beneficiary, average fees, and utilization per beneficiary, first *in toto* by tracer, then for eight types of services.

Blue Cross
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of Michigan

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THE IMPACT OF PHYSICIAN SUPPLY AND REGULATION ON PHYSICIAN FEES AND UTILIZATION OF SERVICES

Chapter 2

COMPETITION AND INDUCEMENT: THEORIES OF THE EFFECTS OF PHYSICIAN SUPPLY ON UTILIZATION AND FEES

Introduction

This chapter develops the theory and empirical specification for two alternative models of inducement.[1] It is divided into nine major sections. In the first, a simple "Reinhardt Test" of inducement through an equilibrium model is proposed. Although such a model is commonly found or implied in the literature and can generate useful results, the remaining sections of the chapter are devoted to a more rigorous examination of the inducement concept.

In the following three sections, a taxonomy of models of the physician firm and/or the market for its services is developed in order to determine which, if any, produce direct tests to distinguish inducement from other hypotheses. When the classification is based on the most significant characteristics separating the various classes of models that have appeared in the literature, it is shown that no unique direct test of inducement can be found. If the inducement controversy is to be resolved, it thus follows that new directions must be explored.

Section Five introduces a precise concept of inducement which is easily incorporated into models of optimal decision making. The purpose is to see whether a careful definition of inducement determines both the conditions and classes of models with which it is consistent. It follows from the definition that one necessary condition is the existence of a gap between the quantity of services that fully informed patients would demand at the prevailing price and the quantity physicians would like to provide.

Two cases are consistent with such a gap. The first is any situation in which a firm has monopoly power. With a downward sloping demand curve, the difference between price and marginal cost at the usual optimum creates an incentive for demand inducement. Every price

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[1] The more technical portions are found in Appendix A. Also, the tracer component of the study is taken up separately in Chapter 7.

maker would like to sell more at the profit maximizing price because marginal revenue exceeds marginal cost. The implicit assumption in traditional models is that buyer information is complete or at a level such that any attempts to induce demand would impose sufficiently costs on the firm to reduce its total profits. Thus, another condition for inducement is a degree of consumer ignorance which establishes a favorable marginal revenue-marginal cost calculus for activities that can be used to augment demand.

This condition must hold also for the second case which is consistent with inducement. A similar gap between the fully informed quantity demanded and the quantity that providers want to supply would arise in a market of price takers in which price rigidities prevented the gap from being eliminated by competitive forces. If consumers are at least reasonably well informed, demand creation is limited and the market remains in a state of excess supply or demand until either price or some other adjustments take place. If, as above, the ability of buyers to make informed choices is sufficiently limited, however, it will be in the profit interests of providers to create demand. The gap will be partially closed through the production of induced output.

Unlike the second approach, the monopoly case does not yield unambiguous comparative static predictions. Furthermore, because it handles only positive levels of inducement; because the price maker acts as price taker when prices are rigid; and finally because there is evidence that usual, customary and reasonable reimbursement methods have, at least in Michigan, reduced both the ability and willingness of physicians to make price changes, formal models of supplier inducement which incorporate the rigidities hypothesis are given in Section Six. Actually, two distinct though closely related models are proposed. A short run variant in which prices are fixed is used to estimate the magnitude of inducement and changes in induced output that follows changes in exogenous variables such as the physician-population ratio. A long run model with a lagged competitive price adjustment mechanism is suggested to measure the strength of competitive forces. The final three sections of this chapter discusses the econometric specifications of the structural equations of both models.

2.1 An Equilibrium Model

In standard theory, greater per capita physician supplies, holding exogenous demand factors constant, should be positively correlated with utilization per capita and negatively correlated with average fees. This correlation provides a test of the inducement theory commonly implied in the literature. Let

(1) $D = a_o + a_1 P + a_2 Y + a_3 MDPOP \qquad a_1 < 0,\ a_3 > 0$ (assumed)

(2) $S = b_o + b_1 P + b_2 N + b_3 MDPOP \qquad b_1 > 0,\ b_3 > 0$

be the demand and supply equations with $a_3 > 0$ if inducement exists. At equilibrium, D=S, and equations (1) and (2) can be solved for the equilibrium price, $\bar{P}$:

(3) $$\bar{P} = \frac{(a_0 - b_0)}{(b_1 - a_1)} + \frac{a_2}{(b_1 - a_1)} Y + \frac{-b_2}{(b_1 - a_1)} N + \frac{(a_3 - b_3)}{(b_1 - a_1)} MDPOP$$

The static price equation (3) is assumed in standard neoclassical models (SNM) to be a positive function of Y and a negative function of both exogenous supply factors, N and MDPOP (if $a_3 = 0$). A positive coefficient for MDPOP in the price equation, holding Y and N constant, is inconsistent with the SNM and could be interpreted as evidence of physician-induced demand. Simple cross tabs between P and MDPOP are usually positive, but only if Y and N are held constant and P and MDPOP properly measured, will correlations between P and MDPOP provide a meaningful test. It is important to note that this test requires not only that inducement occur, i.e., $a_3 > 0$, but that the positive difference between a_3 and b_3 be statistically significant. It is quite possible that $a_3 > 0$ (i.e., inducement exists), but it does not lead to higher equilibrium prices.

Because the empirical specification of this model is very similar to the disequilibrium fee equation in Section Six, a discussion of the dependent and independent variables, and related measurement problems, is found after the latter is developed. Similarly, some theoretical issues relating to the interpretation of the test are also discussed in the following sections. However, as for estimation, if all independent variables are exogenous, equation (3) can be estimated using OLS techniques. A reasonable case can be made, however that physicians are attracted to high density areas, and thus there is a simultaneous relationship between densities and fees in aggregated analysis (but, not in individual physician regressions (Sloan, 1982)). If the vector of exogenous demand variables perfectly captured all the effects of stronger demand, no feedback of prices on densities would exist and the test would be unbiased. To the extent that Y inadequately measures effective demand, an upward bias in the MDPOP coefficient presents a problem. It is therefore important to measure Y correctly.

Equation (3) will be estimated using both market aggregated and individual physician data for 1975-1980. Separate equations will be run for various composite bundles of services and for different specialty groupings. Induced demand should be more prevalent in specialties and for specific groups of services where the care provided is more discretionary and insurance coverage more complete.

2.2 Models of the Utilization and Pricing of Physician Services: a Taxonomy

The objective in this section is to classify systematically on the basis of key distinguishing characteristics all possible models of the physician firm and/or the market for its services in order to determine whether direct tests of the inducement hypothesis can be developed. As by-products of this methodology, the existing literature can be surveyed and elements of the classification matrix that have not yet been considered can be formally developed.

Although there is substantial variation among those theories that have been proposed, most are defined by combinations of the following four major distinguishing criteria. These are: (i) whether inducement is considered or not; (ii) whether the individual physician is a price taker or has monopoly power; (iii) whether the physician is a profit or utility maximizer; and (iv) whether quality/amenity factors are recognized or not. Before the various possible outcomes are examined, the significance of each of these criteria are discussed below.

2.2.1 Demand Inducement

The most important criterion for this project is whether a model incorporates an inducement mechanism and, if so, whether the inducement hypothesis can be distinguished through its properties from the no-inducement hypothesis. Models that can make this distinction provide direct tests of inducement, otherwise at best, only weak indirect evidence can be found to support either theory. In other words, it may be possible to find empirical support from estimates of equations derived from either or both an inducement or no-inducement model. Conclusive evidence, however, can come only from predictions that clearly discriminate one hypothesis from the other.

A prerequisite for such a test is a theoretically sound concept of inducement--a need that is inadequately dealt with in most models of demand creation. While a more detailed discussion of the requirements for an economically meaningful and logically consistent inducement apparatus is found in the fifth section, inducement can be introduced in two general forms. In the Evans (1974)-Reinhardt (1978) formulations, inducement augments demand on one side and imposes costs in the form of disutility to the physician on the production side. A more appealing arrangement, and one which is also more compatible with conventional theories of the firm, is to introduce it directly into the cost function in the form of time and the present value of foregone business (Darby and Karni, 1973) associated with trying to persuade patients to consume more or less than they would if they were fully informed. Seen this way, inducement is analytically equivalent to, although very different in an ethical or public policy sense, advertising or product quality decisions. Changes in each shift demand, impose costs, and all are optimized together with other decision variables. Under certain conditions, it is theoretically possible within this framework to specify a unique test for

inducement. The major problem is empirical. No measure of the resources used in the inducement effort is available; some technique is therefore needed to separate its effects on price and utilization from other effects.

Unfortunately, we have not been able to develop an alternative to the common practice of measuring inducement as the residual change in demand after the influence of those other variables have been accounted for. What will distinguish this from other inducement studies, however, is a structural model that provides a direct test as well as method for estimating the magnitude of this phenomenon and a data base that permits the test to be carried out.

2.2.2 Price Taker or Price Maker

There is considerable confusion in the literature arising from inappropriate terminology and incompletely specified concepts in classifying the market for physician services. The traditional focus has been on whether the market is competitive or monopolistically competitive or whether it consists of a group of local monopolies. There are actually a larger number of distinctions that should be drawn. First, the controversy over whether the market is competitive or monopolistic has in fact dealt with the more limited question of whether the market clears or not. A competitive framework must also include entry and long run equilibrium, elements ignored in models considered "competitive." The same holds for models that have been termed "monopolistically competitive." An equally significant omission among the latter group of models has been the failure to consider the relationship between the pricing decision of the individual physician firm and equilibrium among the group of physician firms which constitutes the relevant market--a key element of the Chamberlinian approach. The "monopolistically competitive" models in the inducement literature do incorporate a monopoly element (a downward sloping demand curve) and a competitive element (shifts in the demand curve through entry and exit), but their precise relationship to the standard model has not been made clear. It seems that the "monopolistically competitive" models of the physician firm that have been introduced are consistent only when the individual firm's demand curve is a share of the market demand curve and has the same elasticities as that curve. If the physician's ex ante demand curve were different, e.g., more elastic, any price adjustment by the individual physician to an exogenous change such as in the physician-population ratio would not lead to the expected equilibrium because all physicians will be making similar price adjustments and their ex ante demand curve will be incorrect. This is the reason why some kind of adjustment process and group equilibrium needs to be specified in a correct monopolistically competitive framework.

Closely related but not identical with the market clearing-monopolistic issue is whether the physician is a price taker or a price maker. Of course, if it is assumed that the market clears, physicians must be price takers. (Although production equals quantity

demanded in monopoly solutions, they are not considered market clearing equilibria because price is greater than marginal cost.) However, the reverse is not true. Physicians could be price takers, but the market need not clear if, for example, there are effective price ceilings or price floors. (Even firms with downward sloping demand curves could for a time be put in the position of acting as price takers, if, as a result of rigidities, fees cannot be set at the optimum levels.) The hypotheses that the market for physician services does not necessarily clear in a short run equilibrium is an important element of the inducement model that will be proposed. For purposes of the taxonomy, however, models will be considered either as market clearing or as monopolistic.

2.2.3 Utility of Profit Maximizing Behavior

With an "efficient doctor market", the physician firm will operate at the profit maximizing level of output (Ramsey, 1980). The physician's utility function determines whether he himself works the corresponding level of physician input or deviates from that level either by hiring additional physician labor or by hiring himself out to other firms. The firm's supply curve of output with respect to price must be the normal positively sloped schedule for competitive firms, although the doctor's supply of labor (to his and/or other firms) with respect to the wage rate may bend backward.

In the absence of an efficient doctor market, however, the physician's utility function is relevant in determining the degree to which his input and the magnitudes of the trade-offs between profits and other arguments of the utility function deviate from the efficient profit maximizing level of input. Here, the physician firm's supply curve of output as well as the physician's supply curve of labor may be negatively sloped.

For the inducement issue, however, there is no reason to believe that this distinction is important. It is generally agreed that either a utility approach or a profit maximizing model, which recognizes the opportunity costs of the physician's time is acceptable. The latter is likely to produce some operational simplicity and reduce ambiguities in comparative static analysis.

2.2.4 Quality/Amenity Variables

While most studies try to correct for differences in case mix when measuring output, there has been increasing emphasis recently on variations in the quality of care or of the amenities enjoyed by patients as they purchase a given set of procedures. Quality/amenity variations would not be important if they were independent of changes in physician densities or other variables of interest. This surely is not the case for at least one amenity--waiting time. Equally significant, physicians may systematically vary the quality/amenity characteristics offered to patients as changes in population-physician ratios affect their market shares.

Minimally, failure to introduce this dimension could produce measurement errors in price and output variables as well as misspecification of the equations of the model. Ideally, one would want, not only to measure the major quality/amenity features, but also to treat them as endogenous variables through a model of decision-making within the physician firm. If this is impossible for lack of data, some other corrections of the raw data must be introduced to estimate quality adjusted price and output if the empirical results are to be plausible. The taxonomy will not deal with the various possible solutions to the problem, but will distinguish models only on the basis of whether or not they introduce quality/amenity considerations.

2.3 Market Clearing Models

There are eight possible market clearing models that can be developed around the distinctions that have been established. If one is not concerned about the question of utility or profit maximizing behavior and assumes positively sloped supply curves of output, four possibilities remain. A utility maximizing model, if there are negatively sloped supply curves of physician labor, may (though not necessarily) result in negatively sloped supply curves of output in the absence of an efficient doctor market. Whether this would happen depends on physicians' production functions. If this possibility is not eliminated, there would be even more ambiguity in the models described in this section. These are discussed below;

2.3.1 Market Clearing; No Quality/Amenities; No Inducement

This is the basic short run competitive model whose properties are well known. In particular, increases in supply: (1) reduce equilibrium price, individual physician incomes, and individual output, and (2) increase aggregate and per capita output.

2.3.2 Market Clearing; Quality/Amenities; No Inducement

An extensive analysis of product quality as a decision variable is found in Hirshleifer (1980). As shown in Appendix A (pp. 1-6), the results do not deviate from the standard case in 2.3.1 when expressed in terms of quality-adjusted price and measures of ouput. However, it is possible for the unadjusted price to increase and unadjusted total output to fall following an increase in supply. It thus becomes clear that if quality variation is or can be significant, adjustments for quality changes have to be considered, even if a market clearing model is not thought to be appropriate.

2.3.3 Market Clearing; No Amenities; Inducement

Inducement has commonly been represented (e.g., Fuchs, 1978 and Newhouse, 1978) through shifts in demand which follow exogenous increases in supply to show that market price may even increase, unlike the ambiguous decrease predicted in the absence of inducement. Although reduced form price equations have been used to test for inducement through this approach, in Section 2.5.1 we show that by inadequately establishing a motive for inducement and by ignoring the costs of inducement, the underlying theory is defective. Furthermore, in a mathematical sense, such a model cannot predict the equilibrium level of inducement--a clear indication of serious problems. Any empirical results derived from this approach, whether or not they support inducement, should be interpreted with great care.

2.3.4 Market Clearing; Amenities; Inducement

The preceding problems are not overcome by introducing quality/amenity variables. While estimates of a positive effect of supply on quality adjusted price raise serious questions, in the absence of a well-developed rationale for inducement in a market clearing model, such findings are not conclusive evidence of a supplier-induced demand. This result will be seen more clearly from the discussion in Section Five.

2.4 Models of the Physician Firm with Monopoly Power

Because both utility maximization and profit maximization have been extensively treated in the literature, this distinction will be retained here. Note that the emphasis in this group of models is on the individual physician rather than on the market. Also, unlike the last two cases above, where inducement is very loosely introduced as a shift in the market demand curve, a corresponding absence of motives cannot be ignored when the focus is on the individual decision maker. Treating the decision to induce as analytically equivalent to product quality or advertising decisions leaves two models for profit maximization and two possible models for utility maximization.

2.4.1 Monopoly Power; No Inducement (or Quality/Amenities)--Profit Maximization

This is a standard monopoly case in which the problem is to determine the effects on price and output of shifts in demand. It is easy to show (Appendix A, p. 7) that decreases in demand arising from any exogenous change such as an increase in the physician-population ratio will reduce both price and quantity.

2.4.2 Monopoly Power; Inducment (or Quality/Amenties)--Profit Maximization

Considerable attention has been given to this approach, especially by Sweeney (1979) and Wisniewski et al. (1980). The model that we are using to represent this case is in fact very similar to one developed by these authors. In this model the profit function can be expressed as

$$\Pi = PQ(P,Z;R) - C(Q(P,Z;R),Z)$$

where Π, P, Q, and C represent profits, price, quantity, and total costs, respectively, Z represents a quality or inducement variable (or a vector of these), and R represents some exogenous factor that can shift the firm's demand curve (such as the population-physician ratio). In this formulation, attempts to induce increases in demand enter directly into the cost function.

One immediate result, assuming non-zero equilibrium values of the decision variables, is that there is an optimum level of inducement. Whether the induced component of output is great or small will depend upon the rate at which the costs of inducement increase and the sensitivity of demand to this behavior.[2] (The equilibrium conditions are

[2] Other things being equal, as buyer information improves, the equilibrium level of inducement decreases until in the limiting case with perfect formation it is no longer a relevant consideration.

illustrated graphically in Section 2.5.2.) Unfortunately, all the comparative static predictions of the model are ambiguous (Appendix A, pp. 8-11). Thus, this theory cannot predict how exogenous changes in demand affect the equilibrium values of P, Q, and Z.

2.4.3 Monoply Power; No Inducement (or Quality/Amenities)--Utility Maximization

This case has been referred to as the standard neoclassical model in the well-known Sloan and Feldman (1978)--Reinhardt (1978) exchange. While there is some ambiguity in the comparative static properties of this model, it predicts unambiguously that increases in the physician-population ratio increase the aggregate output of services, though not necessarily the output per physician, and decrease the fees for doctors' services. This result serves as the basis for the "Reinhardt Test", which suggests that evidence linking price increases to increases in physician densities, should be interpreted as support for inducement. For reasons already briefly discussed, and which will be clarified once our inducement model is developed, we believe that strong conclusions cannot be derived from such price tests.

2.4.4 Monopoly Power, Inducement (or Quality/Amenities)--Utility Maximization

Here there are two variants, depending on the way inducement is handled. In the Evans-Reinhardt extended utility function, the cost of inducement is a psychic cost giving disutility to the physician. Unfortunately, the model has no predictive power through its comparative static properties. Because any empirical results are consistent with the model, it cannot be used to distinguish between competing hypotheses. Likewise when inducement is treated in our preferred way, as with respect to quality or advertising, the model becomes a more complex variant of 2.4.2, and not surprisingly, yields no unambiguous comparative static predictions (McCarthy, 1980).

2.4.5 Summary

An examination of all possible models differentiated by the commonly accepted major distinguishing characteristics fails to produce, in the absence of observations for an inducement variable, a direct test of this phenomenon. The "Reinhardt Test" is a limited one in that it is not applicable when quality/amenity variables are included, and even if the test were verified, the evidence could not be interpreted as uniquely supporting the inducement hypothesis. In fact any monopoly model will predict positive amounts of inducement given the usual theoretical assumptions of smooth continuous functions and interior solutions. The major task is to estimate its magnitude and changes in this quantity arising from changes in physician densities. Thus it is clear that either new directions must be taken or that existing models must somehow be

constrained so that this objective can be met. Such a model is proposed in Section Six following a more thorough analysis of the incentives and costs to providers of activities intended to induce increases in demand.

2.5 Provider Inducement: Further Considerations

The induced component of demand will be defined as the differences between the quantity of services consumed by a patient and the quantity that the patient would consume were the patient fully informed (or if the physician acted as a perfect agent for the patient). By fully informed we mean that the patient has the physician's expertise. We will not distinguish between differences in treatment that may follow from the physician acting solely in the interests of the patient on the basis of the information that the physician may have about the patient's preferences and decisions that the patient would make if the patient had the physician's medical knowledge. We are ignoring, also for the time being, quality and amenity considerations.

Darby and Karni (1973) have convincingly shown how imperfect information creates a climate conducive to fraud (or demand inducement). They show also that, when the demand for a firm's product is stochastic, as is likely to be the case for many physicians, even competitve firms have an incentive to create demand when the length of the queue of customers is small or zero. They suggested a simple way to examine the firm's optimum decision by including a function representing the expected present value of future profits from any client with a term that reflects the probability, which is a function of the quantity of services suggested, that the patient will seek out another provider.

For doctor services, other costs may include the increased probability of malpractice suits as well as the physician's time and effort in trying to persuade the patient to accept additional services. At the anticipated profit-maximizing equilibrium, the expected value of the additional revenues generated through inducement must equal the expected cost including production costs and the costs associated with inducement including those that reflect the possible loss of that patient's business.

Although public concern over demand inducement is not with the occasional lengthening or shortening of the service process resulting from variations in the queue of patients, the relevance of the Darby and Karni framework is to show that a theoretically consistent model must include an incentive, a means, and costs to providers of engaging in inducement or fraudulent activities. The model proposed in Section Six extends these concepts to deal with widespread provider inducement that is not motivated by the scheduling problems created by a stochastic demand. In fact, as shown below, outside of the stochastic demand case, inducement is inconsistent with a market clearing model in which prices quickly adjust to the equilibrium levels.

2.5.1 Provider Inducement in a Market Clearing Model

The conventional way of graphically illustrating the inducement problem is shown in Figure 2-1. Here D_1 and S_1 represent some initial

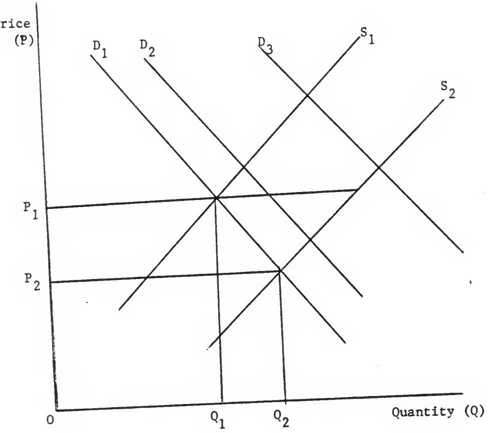

Figure 2-1

MARKET DEMAND AND SUPPLY

state with an equilibrium price and quantity of doctors' services at P_1 and Q_1, respectively. In the absence of inducement, an increase in the supply of physicians to S_2 would decrease price to P_2 and increase quantity demand to Q_2. Inducement is typically introduced as a shift in the demand curve to D_2 or D_3 such that the new equilibrium price lies above P_2 (it will even be higher than P_1 with D_3), and patients consume larger quantities on the new demand curve than they would have on the original demand curve D_1.

A serious flaw with this model is that, if prices adjust immediately to P_2, suppliers will want to provide the quantity Q_2 that lies on the original demand curve. Physicians would not want to create any demand at all at this price even if demand inducement were costless. Moreover, the model does not deal with the conditions for determining the equilibrium level of inducement. The source of these difficulties is a failure to deal with the firm's incentives and costs in creating demand. A careful examination of these questions will demonstrate conclusively that the inducement shown by D_2 or D_3 will not arise, but that price and quantity will settle at P_2 and Q_2, respectively, if the market is a competitive one. The model has to be modified to establish conditions consistent with inducement.

To see this, Figure 2-2 indicates the usual demand and supply conditions for a competitive firm. At the initial equilibrium market price P_1, the typical individual firm, assuming an infinitely elastic demand, wants to and can sell the profit-maximizing, fully informed level of output q_1 at point a. With an exogenous increase in supply, the firm's business at P_1 falls to the amount indicated at, for example, point b. There is an excess supply in the market and, for the typical provider, a gap between the quantity that the firm would like to provide and the quantity that fully informed patients would demand. If it is possible to induce increases in demand without incurring costs (psychic or otherwise), it follows that the aggregate demand curve will be shifted out although not to a level such as D_3 in Figure 2-1, because individual firms will not want to produce more than at a. In the absence of both an effective constraint on demand and inducement costs, prices will remain at the initial level P_1 (and never higher), although aggregate production increases by the amount of the additional induced component. Reinhardt-type price tests are limited, for they indicate possible problems other than or in addition to inducement.

If, however, there are costs associated with inducement, rather than incurring these costs, the competitive firm will lower price by a small amount, believing that demand will become infinitely elastic and it

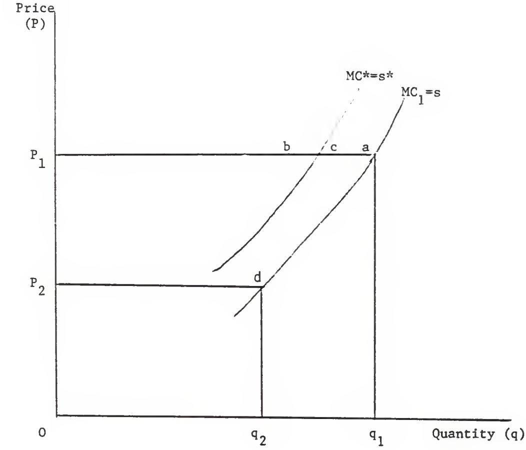

Figure 2-2

THE INDIVIDUAL FIRM

will be able to sell its desired output. (This is analogous to the implicit assumption that competitive firms will not advertise when there is an excess supply, and that price serves as the clearing mechanism.) The price cutting process continues until the equilibrium combination P_2, Q_2 is reached in Figure 2-1 with the typical firm producing q_2 at point d in Figure 2-2.

When, however, this competitive process is prevented from taking place, for example, as a result of price rigidities, the firm has an incentive to close the excess supply gap by improving quality or inducing increases in quantity. Of course, costs have to be considered as well. Before examining this case, we will show that inducement is also inevitable in markets in which the physician has monopoly power in the form of a downward sloping demand curve.

2.5.2 Provider Inducement in Monopolistic Models

Figure 2-3 illustrates standard monopoly profit maximization. Ignoring quality, advertising, or inducement in the demand curve $D(P,Z = 0)$, where Z measures inducement effort, the usual MR = MC condition produces the optimum price-quantity combination with P_1 and Q_1, respectively (again assume that D represents the fully informed demand). Suppose, however, that demand can be shifted through inducement, because of buyer ignorance, but that costs are also incurred as shown by the following equation previously introduced.

$$\Pi = PQ(P,Z;R) - C(Q(P,Z:R),Z)$$

At the new equilibrium, there are now two marginal conditions instead of the usual one, that must be satisfied to reflect the additional decision variable Z. The two conditions, formally derived in Appendix A (p. 8), are as follows. First, holding the quality/amenity/inducement level constant (i.e., Z), the marginal revenue associated with a price change must equal the marginal cost of producing the additional output. Second, keeping price constant, the marginal revenue (which equals price) of the additional production generated by increasing Z must equal the sum of the production and inducement costs of those units.

Because there are an infinite number of demand curves corresponding to all possible values of Z, Figure 2-3 shows only the equilibrium result in which both conditions are satisfied. In Figure 2-3, the optimum level of inducement is Z* which corresponds to the shifted demand curve $D(P,Z = Z^*)$. The schedule MC_Q represents the standard

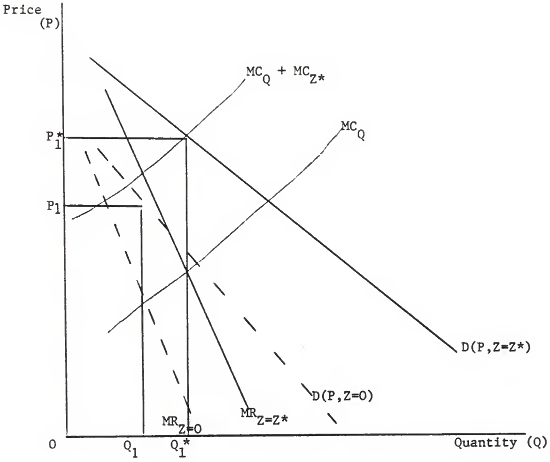

Figure 2-3

EQUILIBRIUM FOR A MONOPOLIST

marginal (production) cost curve. However, there are also inducement costs. The total inducement costs (not shown) divided by the optimum quantity Q^*_1 yields an ex post marginal (average) cost MC_Z^*, known only after the optimum is derived. The schedule $MC_Q + MC_Z^*$ which is the sum of the marginal production and inducement costs lies parallel to MC_Q.

Both equilibrium conditions are satisfied at the price-quantity combination P^*_1, Q^*_1. Keeping Z constant at the optimum level Z*, the marginal revenue associated with changing price is given from the marginal revenue schedule ($MR_{Z} = {}_{Z^*}$) corresponding to the demand schedule D(P,Z=Z*). At a production level Q^*_1 and a price P^*_1, the marginal revenue (i.e., P^*_1) of the last unit of induced output is equal to the sum of the marginal production and inducement costs (i.e., $MC_Q + MC_Z^*$).

It is the price-marginal cost difference in the standard monopoly solution that provides an incentive to augment demand. That is, every monopolist would like to sell more at the profit maximizing price because marginal revenue exceeds marginal costs. Where, however, buyer information is perfect or at a level that would result in very high inducement costs, little or no inducement is expected. If, on the other hand consumer are relatively uninformed and, at least initially, inducement costs are relatively low, the rational monopolist's reaction would be to induce output until the profit-maximizing conditions are satisfied. In some markets, of course, ethical or other constraints may limit this sort of behavior.

There remains, however, a major obstacle in going from a theoretical proof that inducement will be found in markets with monopoly power and imperfect information to an empirical determination of either the existence or the extent of inducement. With direct observations on inducement effort and inducement costs, the existence question would be settled immediately and only the effect on demand left for estimation. Obviously, since there is no way of directly defining and measuring Z, the alternative is to use the predictions of a model with respect to measurable phenomena to distinguish inducement from a no-inducement hypothesis. While this model predicts that inducement will exist as long as there is imperfect information, all its comparable static properties are ambiguous (Appendix A, pp. 8-11) and thus its validity cannot be tested. The model is nevertheless valuable because it provides strong a priori justification for believing that at least some inducement may be found in the market for doctor services. An alternative mechanism, however, is required both to measure the extent of inducement and examine how it varies with changes in exogenous variables such as physician-population ratios.

2.5.3 Provider Inducement in Models with Price Rigidities

In both the Darby-Karni and monopolistic cases, favorable conditions for inducement are created by a gap at the existing price between the quantity of services that the provider would like to sell and the quantity that fully informed consumers would purchase. A similar situation is created for both price makers and price takers when fees are fixed at least for some period of time.

Although the concept of price rigidities has not been widely used in the inducement literature, the idea is well established in other areas. In macroeconomics, the downward inflexibility of prices distinguishes Keynesian from classical models by making possible a less than full employment equilibrium. In the field of industrial organization, price stickiness is considered a prominent feature of monopolistic and oligopolistic industries, where it is argued that firm in these industries are more likely to change production levels, product quality, or advertising effort rather than price in response to changes in market conditions.

While the market for physician services may share certain monopolistic elements with these cases, and as it is considered unethical by the AMA to use price competition to attract patients away from other physicians, the usual, customary, and reasonable (UCR) reimbursement mechanism is the principal contributor to the relatively high degree of short run and possibly even long run price rigidity. In the short run ".... the participating physician behaves like a price taker in the UCR submarket..." "(Yett, et al., 1980, p. 12). Thus, his average revenue schedule is horizontal up to the quantity demanded, which may in the absence of inducement fall short of the quantity that the physician would like to provide.

Over the longer run, UCR reimbursement also may prevent fees from adjusting rapidly toward market clearing levels. For example, Blue Cross-Blue Shield of Michigan raised its screens only three times between 1974 and 1980. The individual physician, however, is bound also by his customary profile as the maximum payment is the lesser of the two. Customary profiles may be revised no more than once a year and are subject also to maximum increases. Since 1975 these annual increases in Michigan have ranged between 5 and 8 percent. Rarely does a physician charge less than his customary profile, and on approximately 95 percent of all reimbursable claims he will accept the Michigan Blue Shield determinations of payments as payment in full. This behavior is to be expected as a rational decision maker has no reason to charge less than the maximum amount that Blue Shield is willing to reimburse him for his services. Thus, there is effective downward nominal price rigidity while at the same time the effective nominal price increases for Michigan Blue Shield patients are substantially constrained (although physicians may increase their charges to any level). It is thus reasonable to believe that, over the short run or even longer periods of time, the price limits defined by UCR prevent the system from reaching a market clearing equilibrium.

The properties of an Evans-Reinhardt extended utility maximizing model when fees are held constant are found in Appendix A (pp. 12-19). Measuring product output by physician input, increases in physician densities unambiguously increases the aggregate (and thus per capita) levels of induced output. It is shown also that the increase in total output will be less than the shift in the (desired) supply of physician services. Individual physician workloads and income levels will decline.

Given the advantages of a profit maximizing approach that includes the cost of inducement directly in the cost function, and because the link between physician input and product output is not well developed in utility maximizing models, we will focus on this case. The equilibrium condition for this model and the unambiguous comparative static property that exogenous increases in physician-population ratios increase the levels of induced output are derived in Appendix A (pp. 20-21). These useful results can be illustrated within the context of Figure 2-2. Suppose that at the market price P_1, the fully informed quantity demanded (or when the physician acts as a perfect agent for the patient) is q_1. Letting MC_1 represent marginal production costs, the physician will want to provide q_1 units of output to maximize profits--the same quantity that is demanded. Although we assume the physician is capable of inducing increases (or decreases) in demand, it is not in his interest to do so. If this is a representative physician there is no inducement at the market equilibrium which is at the market clearing solution at A in Figure 2-4.

Suppose that this initial equilibrium is disturbed by an increase in the supply of physicians such that the typical doctor's workload at the fully informed level of demand falls to the level indicated by b in Figure 2-2. If price does not immediately fall to P_2 in Figure 2-4 which again would produce an equilibrium with no inducement (so that the typical physician would provide q_2 units of output in Figure 2-2), a gap between the fully informed quantity demanded and the quantity that the price taker would like to provide is formed. At the price P_1 the gap for the typical physician is ab in Figure 2-2 and AB in the aggregate in Figure 2-4. The model predicts that inducement efforts will continue as long as the marginal revenue of induced production exceeds the sum of the marginal production and inducement costs until a new equilibrium is reached at an output of c in Figure 2-2 where the combined marginal cost schedule MC* (S_2 in the aggregate in Figure 2-4) intersects the price line. The increases in production from b to c (AC in the aggregate) represent the induced components of output. Further increases in supply, if prices hold at P_1, would produce additional inducement although, as shown in Appendix A (p. 19), increases in induced output will be less than increases in supply (e.g., AC $<$ AB in Figure 2-4). For any fully informed level of demand, there is a locus

relating price to output corresponding to every supply schedule (e.g., Q_1Q_1 and Q_2Q_2 are the loci corresponding to S_1 and S_2, respectively, in Figure 2-4). Only at points such as A and D, where fully informed quantities demanded equal desired quantities supplied, is there no inducement. At higher prices firms close their gaps and settle at respective equilibria in the fashion described above. At lower than market clearing prices, providers could remain on their supply curves by providing less than the fully informed demands, but with costs in doing so (e.g., increased threat of lawsuits and the loss of future business) the effective marginal benefit of providing additional services exceeds the price, and physicians will expand output. Equilibrium output will lie between the fully informed aggregate demand and desired supply as shown in Figure 2-4, although the output loci could be kinked at the market clearing levels.

The theoretical and empirical problems that remain are to determine what eventually happens to price and how to estimate the extent of inducement. The following sections propose, in addition to a short run model of inducement, a long run model in which competitive forces eventually drive price toward the market clearing level. This long run model is thus a hybrid of neoclassical and inducement elements. We also show how to estimate both the amount of induced output as well as the speed of the competitive price adjustment.

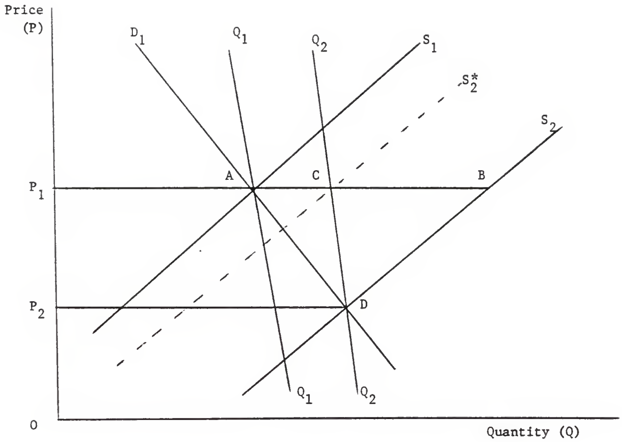

Figure 2-4

MARKET DEMAND, SUPPLY AND INDUCED OUTPUT

2.6 A Model of Supplier Induced Demand

The concept of a gap between quantity demand and desired quantity supplied, with the partial closing of the gap through demand inducement can be easily incorporated into a market model as follows: Let D and S represent aggregate fully informed demand and supply functions, respectively, with

(1) $$D = a_o P^{a_1} Y^{a_2} \qquad a_1 < 0$$

(2) $$S = b_o P^{b_1} MD^{b_2} N^{b_3} \qquad b_1 > 0,\ b_2 > 0$$

where Y represents income and other independent variables in the demand equation, and MD and N represent the number of physicians and other independent variables, respectively, in the supply equation. (The reason for the multiplicative forms for the equations will be seen shortly.) Let Q represent the actual output (consumption) of services which may be neither the quantity that fully informed patients would demand, nor the quantity that physicians want to supply if individual firm demand curves were perceived as infinitely elastic (i.e., output may not lie on either the demand or supply curve because of demand inducement). By approximating the equilibrium level of output at any price with the specification found in both Green (1978) and Stano (1978), then

(3) $$Q = D\left(\frac{S}{D}\right)^{\lambda}$$

where λ represents the magnitude of inducement (positive or negative). If $\lambda = 0$, then Q = D, there is no inducement, and physicians provide the quantity of services that fully informed consumers demand. The other limiting case is with $\lambda = 1$ in which Q = S, and physicians are always able to be on their supply curves.

In terms of Figure 2-4, if price is at the initial market clearing level P_1, output at A will be on both the demand and supply curves, and there is no inducement. If, however, supply increases to S_2, there is an excess supply gap. The $\lambda = 0$ and $\lambda = 1$ cases would result in production levels at A and B, respectively. Nevertheless, our theory predicts that with price rigidities physicians will attempt to close the gap and settle at a point such as C (i.e., $0 < \lambda < 1$). Our goal is to measure the amount by which the gap is closed at any price (i.e., λ) and how the amount of induced output varies with changes in supply. These can be done using the equations that have been introduced. Let us substitute (1) and (2) into (3)

$$\log Q = \log D + \lambda\,(\log S - \log D)$$

$$= \log a_0(1 - \lambda) + \lambda \log b_0 + (a_1(1 - \lambda) + \lambda b_1)P$$

$$+ a_2(1 - \lambda)Y + \lambda b_2 MD + \lambda b_3 N$$

or

$$(4) \qquad Q = \alpha_0 + \alpha_1 P + \alpha_2 Y + \alpha_3 MD + \alpha_4 N$$

where all variables are measured in logarithms and the α's are the coefficients shown above. From the multiplicative form and the reasonable assumption that b_2, the elasticity of supply, is unitary (i.e., a 1 percent increase in the number of doctors increases the supply curve, but not necessarily output, by 1 percent), $\hat{\alpha}_3$ provides an estimate of λ.

The remaining major issue is what happens to price as a short run equilibrium with an excess supply or demand relative to a market clearing equilibrium cannot be expected to be permanently sustained. We propose a long run model in which the lagged competitive price adjustment mechanism introduced by Feldstein (1970) is used to measure the strength of competitive forces. Here

$$(5) \qquad \log P_t - \log P_{t-1} = u(\log \bar{P}_t - \log P_{t-1})$$

where $\bar{P}_t$ is the market clearing price at time t and u measures the speed of the adjustment process. Since quantity demanded equals quantity supplied at $\bar{P}$,

$$\log \bar{P} = \frac{\log b_0 - \log a_0}{a_1 - b_1} + \frac{b_2 \log MD}{a_1 - b_1} + \frac{b_3 \log N}{a_1 - b_1} - \frac{a_2 \log Y}{a_1 - b_1}$$

Substituting into (5)

$$\log P_t = \frac{u(\log b_0 - \log a_0)}{a_1 - b_1} + \frac{u(b_2 \log MD)}{a_1 - b_1} + \frac{u(b_3 \log N)}{a_1 - b_1}$$

$$- \frac{u a_2 \log Y}{a_1 - b_1} + (1 - u)\log P_{t-1}$$

or

(6) $$P_t = \beta_0 + \beta_1 MD + \beta_2 N + \beta_3 Y + \beta_4 P_{t-1}$$

where again the variables are measured in logarithms and the β's represent the coefficients derived above. The speed of adjustment and the strength of competitive forces are determined from $\hat{\beta}_4$ (= 1 - u). For example, with the initial equilibrium at A in Figure 2-4 with demand and supply at D_1 and S_1, respectively, there is no inducement. The quantity of services that providers want to sell at P_1 is equal to the quantity that well informed patients want to consume. With an increase in supply to S_2, a surplus equal to AB is formed. The inducement process that we have formulated results in a partial closing of the gap to C in the short run where AC represents the aggregate quantity of induced output. Over the long run competitive price pressure may be manifested because physicians are still not able to sell the quantity of services that they prefer to provide at a market price P_1. The coefficient u will reveal the extent to which the gap between the current price and the new market clearing price P_2 is eliminated within a given period of time. In other words over the long run, price and production fall along the schedule Q_2Q_2 until the new long run equilibrium is restored at D in Figure 2-4 and once again there is no excess supply or induced output. Of course, in periods where supply increases much more rapidly than demand, then notwithstanding competitive forces, inducement is likely to be a worsening problem.

Finally, the model is symmetric with respect to either excess demand or supply (i.e., in the former region, physicians are induced by professional ethics to work more than they would otherwise prefer), Green (1978) has suggested that this assumption may not be appropriate. For example, the response to a shortage by physicians may be proportionately greater than the inducement effect in times of a surplus. Here, the utilization curves, Q_1Q_1 and Q_2Q_2 in Figure 2-4, would have kinks and smaller slopes numerically, above the respective equilibrium prices (and will coincide with their corresponding demand curves if there is no inducement).

Other areas of this investigation (e.g., the tracer analysis) may be valuable in finding a set of specialties and procedures which are more amenable to inducement and for which a strong case can be made for assuming in which of these markets there is an excess demand or supply. Thus both the symmetry of the model as well as the strength of the inducement effects across services are left open as empirical questions.

The following section specifies more fully the variables and structural equations of the econometric models to be estimated. It also examines alternative strategies for dealing with certain data limitations including any modifications to the basic methodology that are necessitated by the data.

2.7 Econometric Specification of the Empirical Model

The preceding section identified two models to be econometrically estimated. Equations 1 through 3 in that section provide the three structural equations for a model that explains short run output determination. The short run output model is given below (now including time subscripts).

(1) $$D_t = a_o P_t^{a_1} Y_t^{a_2} \ldots$$

(2) $$S_t = b_o P_t^{b_1} MD_t^{b_2} N_t^{b_3} \ldots$$

(3) $$Q_t = D_t \left(\frac{S_t}{D_t} \right)^{\lambda}$$

A long run price adjustment model is the second model to be estimated. The structural basis for this model is nearly identical to that of the short run variant, except that the equilibrium price ($\bar{P}$) in equations 4 and 5 below is substituted for the short run market price in equations 1 and 2. In addition, over the long run, prices will adjust to equilibrates supply and demand. Thus, the equilibrium/disequilibrium condition (equation 3) in the first model is replaced by the price adjustment equation 6 below. Further, the long run price adjustment model is appended with a fourth structural equation, equation 7, to represent the determination of physician density over the long run. While the physician-population ratio is logically fixed in the short run period during which price is constant, a more complex and interdependent relationship exists over the long run, as physicians may change location based on price changes and therefore, perceived income opportunities. Equation 7 is introduced to capture the endogeneity of the physician density variable, MD_t, over the long run. The complete model of long run price adjustment thus becomes:

(4) $$D = a_o \bar{P}_t^{a_1} Y_t^{a_2} \ldots$$

(5) $$S = b_o \bar{P}_t^{b_1} MD_t^{b_2} N_t^{b_3} \ldots$$

(6) $$\log P_t - \log P_{t-1} = u(\log \bar{P}_t - \log P_{t-1})$$

(7) $$MD_t = m(P_{t-1}, Y_{t-1}, \ldots)$$

For this model, note that the price variable in the new demand and supply functions ($\bar{P}_t$) has been redefined as the (unobserved) market clearing price.

The purpose of the next two sections are to specify more fully the variables and functions to be used in the econometric estimation of each of these models. Each seeks to answer a different question with respect to the inducement controversy. The short run output model attempts to identify the gap between observed output and the amount that consumers might choose in the absence of inducement. If all other influences can be reasonably considered to have been held constant in the analysis, then the estimated gap may provide an approximation of the degree of inducement in the physician services market. The long run price adjustment model, on the other hand, approaches the inducement question by attempting to determine the strength of competitive pricing in the physician services market; that is, a well-functioning competitive market should ensure speedy movement toward a market clearing price. If the price adjustment process is sluggish and incomplete, this condition might indicate some ability by physicians to circumvent normal competitive forces.

2.7.1 Data Collection and Bordercrossing Adjustments

Both theoretical models are based on aggregate demand and supply functions. For this analysis, individual office based physician data and locational data are combined for each "market area" by specialty. The data used to represent aggregate demand and supply conditions can be collected by two means. First, all claims for specified bundles(s) of procedures can be used to generate an index of output and price of a standardized unit of output for each market area and for alternative groups of specialties in each market area. The second strategy for collecting and organizing the data is to rely on observations by individual practice from a sample of physicians in each market area. The aggregate demand and supply conditions would then be mirrored by those conditions faced by the representative physician. Although this second strategy appears to be more appropriate because of the improved efficiency of the estimation process and because a more suitable utilization measure can be defined (an index of intensity per patient seen rather than an index of utilization per eligible recipient), both approaches will be pursued.

Finally, one of the major goals of the project is to determine relevant market areas through studies of patient origin and destination. Given the extraordinary results that we have obtained in measuring utilization after accounting for patient bordercrossing, (both the methodology and findings are discussed in Chapter 4), we have found, as expected, that our corrections for price and utilization will have a significant impact compared to unadjusted values on our estimates of the extent of induced demand.

2.8 Specification of the Short Run Output Model

Equations 1 and 2 in Section 2.7 are standard structural supply and demand equations and, with the exception of the price variable, are identical in each model. The third equation in the short run output model replaces the standard equilibrium condition in market clearing models (i.e., S = D). Equation 3 is a more general condition in that an equilibrium between supply and demand is simply a special case of all possible market outcomes (clearing vs. non-clearing).

However, as required by the nature of the data collection (i.e., observations representing the "average physician"), Equations 1 and 2 (plus 4 and 5) must be modified. The physician supply variable MD_t, now enters the structural demand equation rather than the structural supply equation. The physician supply variable logically determines the level of demand faced by the average physician, not the level of supply. Thus the demand curve being estimated represents the average physician's proportional share of the aggregate demand in that market. Further, as we are no longer dealing with the aggregate supply curve, but rather the supply decision of the average physician, it is no longer appropriate to include the physician supply variable as a shift parameter in the supply function. The justification for these transformations can be seen also from Figure 2-2. An increase in physician density does not affect the individual physician's supply schedule (e.g., $MC_1 = s$). It reduces the provider's share of the market and quantity demanded at any price (e.g., the decrease from a to b at price P_1). Thus, Equations 1 and 2 (plus 4 and 5) become:

(1') and (4') $$D_t = a_o P_t^{a_1} MD_t^{a_2} Y_t^{a_3} \ldots$$

(2') and (5') $$S_t = b_o P_t^{b_1} N_t^{b_2} \ldots$$

By substituting Equations 1' and 2' into Equation 3, the econometric process is completed by the estimation of Equation 3. If the system is identified, the coefficients of structural Equations 1 and 2 can then be derived. The purpose of this section is to describe briefly the several variables contained in each of these structural equations.

2.8.1 The Demand Equation

The demand equation represents an estimated schedule of the amounts or intensity of the average physician's services consumed by patients based upon the socio-economic and demographic characteristics of the patient population and the various attributes of the physician practice from which these services are available. The dependent variable D_t, the output demanded, is not observable in a non-clearing market if there is inducement. Thus, the structural coefficients are to be determined by the estimation of condition 3 from Section 2.7.

(Similarly, S_t is not necessarily observed, directly and the structural parameters of the supply equation are to be determined also through the estimation of condition 3.) The dependent variable in condition 3, Q_t, is specified as output per Michigan Blue Shield patient where output is an indexed aggregation of the most commonly performed procedures (from statewide relative charges). This measure of output represents the intensity with which patients are treated. If physicians induced demand, one would likely observe that a relatively higher intensity of service characterized practices in areas having a high density of physicians as they encouraged each patient to utilize a greater amount of services. As a result, inducement on the basis of quantity or visit intensity can be determined by our measure of disequilibrium between supply and demand, which is explained below.

2.8.2 The Price Variable

Of the independent demand variables that will enter the reduced form condition 3, the price variable presents, perhaps, the greatest challenge with respect to a proper specification. Here we must consider four adjustments to the observed price charged. First, because data reflecting the delivery of physician services are aggregated over various procedures, both within a given physician practice and across all practices in a given market area, the price variable must necessarily be indexed to reflect variations in the casemix demanded and delivered. Statewide relative charges for 1977, the middle year of the study, will be used as weights for an output measure in which a brief office visit for established patients will be taken as the base unit (i.e., 1 RVU). Prices will be expressed in terms of $/RVU.

Second, the demand price variables should represent the actual net price faced by consumers; that is, because some portion of the physician's fee is likely to have been paid by Blue Shield, the patient's willingness to purchase physician services is determined on the basis of the net (after-insurance) price, not the full charge. Since the insurance characteristics of the patient are well-know if the data are derived from the Blue Shield patient files, an index of patient out-of-pocket payments can be developed.

Third, the price measure should reflect variations in the quality of care of the amenities offered to consumers as they purchase a given procedure. The models presented above are predicated on the assumption that price and quantity are both quality-adjusted. However, the observed price will reflect quality/amenity differences, as well as the basic compensation for purely medical procedures performed. To account for quality variations, the study will attempt to incorporate the results of a physician survey undertaken by BCBSM. In aggregated analysis, market area averages of important quality/amenity characteristics, e.g., length of office visit, wait for appointment, travel time, and board certification, are directly introduced into the specification.

A final adjustment to the price variable is that each year's price observations from the pooled sample will be corrected for inflation to express real values. Further, for any given year, a correction for cost-of-living differentials between different market areas will be estimated. (The methodology and estimates of the deflators are found in Chapter 3.)

2.8.3 Other Variables

A second variable that enters the demand function is the physician-population ratio, MD_t. As explained above, data for the individual physicians are used in the empirical analysis to represent the aggregate supply and demand conditions in the market. The demand curve being estimated thus represents the typical physician's proportion of the aggregate market demand curve. As such, the relative physician supply measure enters as a shift parameter in the demand function where output is measured in terms of visits. As the number of physicians per capita in a given market area increases, it is anticipated that the average physician's share of the market in terms of visits demanded per week as distinct from the amounts actually provided which include also any increases in inducement will fall proportionately. However, when output is measured on a per patient basis, the density of physicians should not affect the intensity with which patients are treated, if that treatment reflects standard medical procedure for a given diagnosis. The physician-density measure, then, should be insignificant in its influence on the intensity of care. If we find a positive (and significant) coefficient on MD_t, this fact might indicate inducement activity since, at a given price, more RVU's per patient are delivered as physicians encourage greater utilization in the face of excess capacity.

One important caveat here, however, is that intensity may reflect "quality." Thus, higher quality may be offered in relatively physician dense areas, particularly in the face of price rigidities. Whether or not this greater intensity is justified is a separate question, as the typical physician in an area with few physicians per capita may be providing a <u>less</u> than medically acceptable intensity of service. A positive finding would simply indicate that intensity increases as physician density increases.

The physician density measure enters the demand equation exogenously in the short run output model. Since the period of time being considered is so short that prices are assumed to be constant, it is unlikely that physician relocation is a more responsive adjustment alternative than price. Thus, the supply of local physicians is fixed for any year being considered. In the long run price adjustment model, however, the demand equation will contain an endogenously determined measure of physician supply as price changes over time are likely to affect patterns of physician migration. As physician supply also affects price, the relationship must be specified as interdependent.

For each market area, several other variables will be derived for the demand equation specification. Per capita income is included as a measure of the patient population's ability to pay. In order to be sure that the income variable does not reflect the population's education level and therefore ability to produce "health" for themselves, measures of educational achievement and the health status of the population in the market area will be included also. Similarly, measures of the age distribution in each market area will be included to reflect both the differential incidence of illness by group and, for those over 65, the prevalence of Medicare patients. Other demographic variables typically included in demand equations are: percent nonwhite; percent urban; percent female; and number of hospital beds per capita as a substitute or complementary resource.

2.8.4 The Supply Equation

The aggregate supply of office based physician services is represented by a structural supply equation describing the supply choice of the average individual physician. The variables used to explain supply, like those on the right-hand side of the demand equation, will be entered into the reduced form estimation of condition 3. The supply of services offered by the average physician is specified as a function of price (P_t) and a vector of other exogenous variables.

The price variable in the supply equation is specified in the same way as in the demand equation, with the exception that no adjustment is made for the effect of insurance on the price faced by consumers. Since the physician chooses to supply services according to the money that he receives per procedure, regardless of whether the patient or a third party pays for the care, the appropriate specification of price in the supply equation becomes average, not net price as in the demand equation.

The vector of other exogenous variables that enters the supply equation should contain input price data as well as data describing the physician and his circumstances. The study is more limited in this area, but to the extent possible, e.g., through the use of market wage rates, specialty groupings and the survey findings, we can experiment with several proxies for these variables.

2.8.5 The Non-Market Clearing Condition

Condition 3 in the short run output model shown above states that supply and demand need not be at the market clearing level; that is, with short run price rigidities, the quantity or intensity of services actually produced and sold may in one limiting case be set solely by the amount of services demanded by patients, even though the physician might desire to provide more or less service. In the other limiting case,

the observed quantity or intensity might be determined strictly by supply considerations as the physician delivers the quantity dictated by his desired supply curve through positive or negative inducement, if necessary.

When the demand equation (1') and the supply equation (2') are substituted into condition 3, the right hand side variables are composed of all the supply and all the demand variables. These variables have already been described. The two measures of the dependent variable, Q_t require greater elaboration.

One output measure, used with individual physician samples, is the intensity of services provided per Blue Shield patient, where the output measure is of casemix-weighted procedures for a given year. The information needed to construct this variable is drawn from physician/patient claim files as recorded by Blue Sheld. The intensity measure is used for two reasons. First, in examining the inducement question, it is important to know if the manner in which similar patients are treated for the same illness varies by market condition. The second reason why the intensity measure is deemed to be an important focus is that the data are very accurate for Michigan Blue Shield members. Measurement error and its associated problems are minimized as actual physician and patient billings are abstracted with precise price and casemix information. Since all patients seen by physicians are not Blue Shield members, however, the physician/patients files are incomplete with respect to services provided to uninsured patients or patients with non-Blue Shield insurance coverage. Thus, an output measure of services per member allows us to represent the physician's practice by a limited but accurate set of data. (The implicit assumption is that other Blue Shield patients are treated the same.)

The other dependent variable measuring output used in aggregated market area analysis is specified as the total market casemix-weighted output per eligible beneficiary. This index does not reflect any intramarket variations among physicians, but does capture all the Blue Shield care for the procedures under study that has been provided. This index reflects differences also in the proportion of eligible recipients seeking care and physician turnover, i.e., the number of distinct physicians seen by an average patient, across markets. The relationship between the two measures and their implications for our findings are found in Chapter 5.

As described in Section 2.6, the estimation of condition 3 by equation (4) provides important information concerning the possibility of inducement. The coefficient of the MD_t variable in equation (3) is equal to λb_2. Because of the log-linear specification of this equation, b_2

represents the elasticity of output with respect to physician density. When using the quantity output measure and, by making the reasonable assumption that this elasticity is unitary (i.e., the average individual physician's proportional demand curve shifts in 1 percent, ceteris paribus, with an increase in physician density of 1 percent), the value of the estimated coefficient must be equal to λ, the measure of the degree by which the demand curve is rotated through the inducement, activities of the physician. If λ approximates 1, then physicians are able to remain on their supply curve, producing the desired level of output regardless of demand conditions. If λ is equal to zero, output is determined by demand conditions irrespective of the physician's desired level of output. A (significant) λ value between zero and one would indicate the predicted outcome (as described by Figure 2-4) which is an incomplete closing of the gap between the physician's desired output and the output independently demanded by patients. For this last case in particular, the estimate of λ must be compared also with the estimate of u (which measures the speed with which prices adjust to clear the market) from the price adjustment model described below, if a complete picture of the inducement behavior of physicians is to be drawn. For instance, if a (significant) value of λ equal to 0.5 is estimated along with a very rapid ($u = 1$) speed of price adjustment measure, we conclude that, while physicians have and use the ability to induce demand, albeit incompletely, the effective inducement is short lived, as competitive pressures soon produce market clearing prices. Alternatively, a λ value of 0.5 with a low speed of price adjustment estimate, e.g., ($u \approx 0$), indicates that the incomplete inducement by physicians is not readily, if at all, brought in check by competitive forces. Thus, the estimate of λ provides an important clue to determining the degree of inducement in the physician services market.

For the intensity output measure, we would expect b_2 to be equal to zero. Thus, once again, the coefficient on the MD_t variable represents λ. In this case, however, a positive and significant λ represents an increased intensity of care, as opposed to an increased quantity of care, when physician density increases.

2.8.6 Empirical Methodology

A reduced form estimation of condition 3 is produced when all variables on the right hand side of both the supply equation and the demand equation are substituted into the functional form represented in equation 3 and regressed against our indexed output measure. Interestingly, the price variable in this case is an exogenous variable in that the model is both a short run model based on a price rigidity and, more importantly, a non-clearing model. Thus, the usual simultaneity between quantity and price does not necessarily hold as, at a given

price, quantity demanded and quantity supplied might have very different values. Therefore, the error terms in equation 3 are independent of the price at time t (the price variable that enters the right-hand side), even though the error terms are not necessarily independent of prices set in former years (as the now rigid price, P_t, must have been set at some time in the past).

The estimation of the reduced form equation 3 produces the empirical result of key interest. As described above, the coefficient of the MD_t variable represents the estimate of λ, the measure of inducement activity.

2.9 Specification of the Long Run Price Adjustment Model

While the structural equations used in the long run price adjustment model are essentially the same as those used in the short run output model, some important differences exist. Most obviously, the non-market clearing condition specified above as equation 3 for the short run output model is replaced by a price adjustment mechanism that not only represents the long run movement of prices toward a market clearing price, but, more importantly, allows us to estimate the speed with which competitive forces move the market to a long run equilibrium position. A second difference between the models is that the physician-density measure becomes endogenous over the long run. Thus a fourth structural equation is added to represent the determination of the physician-population ratio, MD_t, whose predicted value will be used in the estimate of condition 6 in Section 2.7. The rationale and basic structure of this model have already been presented above. The purpose of the following sections is to identify the differences in specification and estimation technique that exist between the long run price adjustment model and the short run output model already discussed. Only these differences are highlighted below.

2.9.1 The Demand Equation

The specification of the demand equation is exactly the same. With one minor exception; that is, the price variable and the physician density that enter the structural demand equation (4' above) are now endogenous, as we are considering a long run, market clearing model, which logically implies a simultaneous determination of price and quantity as well as a recursive relationship between price and physician density.

2.9.2 The Supply Equation

Similar to the minor modification made in the demand equation, the price variable in the long run, market clearing model is now properly specified as endogenous rather than exogenous.

2.9.3 The Price Adjustment Equation

Equation 6 in Section 2.7 (reproduced below) introduces a new market equilibrium/disequilibrium condition.

$$\text{(6)} \qquad \log P_t - \log P_{t-1} = u(\log \bar{P}_t - \log P_{t-1}),$$

where $\bar{P}_t$ is the market clearing price at time t, and u measures the speed of the price adjustment necessary to achieve a long run equilibrium. Because $\bar{P}_t$ is defined as a market clearing price, implicitly the quantity or intensity demanded must equal the quantity or intensity

supplied. Thus, as presented in Section 2.6, a reduced form estimate of P_t, the observed price, as a function of all the right-hand supply and demand variables and the lagged price, P_{t-1}, will produce an estimate of u, the speed of adjustment parameter. This result is achieved by analyzing the estimated coefficient of the lagged price variable (β_4 in equation 6 of Section 2.6) which is equal to (1 - u). Thus:

$$u - 1 - \beta_4$$

A large u (i.e., u ≈ 1) would indicate a rapid movement toward the market clearing price, whereas a low value (u ≈ 0) would indicate little or no movement toward equilibrium. Clearly, the stronger the competitive forces, the quicker the movement to a market clearing price. When this estimated result is combined with information about the degree of inducement activity, both the extent and the longevity of inducement can be estimated for each specialty and for different procedure types to help measure how distortive the inducement practices of physicians might be.

2.9.4 The Physician Density Equation

The final equation in the long run price adjustment model is the structural equation to estimate the physician-population ratio (MD_t). This measure of the relative supply of physicians enters as an endogenous variable in the demand equation. The endogeneity of MD_t reflects that physicians may enter and exit markets according to the relative rewards available between market areas. If for a given market area the real income and insurance levels of the population are sufficiently high to produce high income opportunities for physicians, we would expect more physicians to move into this area. Since the analysis deals with a panel of cross-section observations over a period of five years, a proper specification of the physician density measure requires that the changes in the physician density because of "economic" migration be held constant. The demand equation specified above suggests that the price and output of the average physician are determined in part by the level of physician supply in the market area. However, the supply of physicians is determined also by the price that they receive for their services (in this case, lagged one year) as high relative prices encourage in-migration while low relative ones, encourage out-migration. The physician-density equation is introduced explicitly to control for this systematic relationship.

The physician-population ratio at the time t (MD_t) is specified as a function of all predetermined variables. This ratio function includes a predetermined variable (P_{t-1}). While price at time t (P_t) is an endogenous variable, physicians are assumed to move in response to prices observed at some time in the past (P_{t-1}). Consequently, the supply of physicians that have settled into office-based practice at time t (MD_t) is a function of the economic conditions perceived <u>before</u> the move (which are assumed to have encouraged the shift in location). These economic conditions in the market area include the average price (indexed for casemix, quality-adjusted, and deflated) lagged one year (P_{t-1}); real personal income; the availability of medical resources (e.g. hospitals and other specialists); and cultural/environmental variables. As a broad proxy, the percent of the population urbanized will be entered to reflect the general availability of consumption choices and cultural options. Moreover, the educational level of the market area has been shown to be an important locational determinant (Cantwell and Eisenberg, 1975) and will be included in the analysis.

2.9.5 Empirical Methodology

As a block recursive system, the predicted value of MD_t is estimated as a function of a set of predetermined variables and plugged into the structural demand equation. Equations 4' and 5', the structural demand and supply equations, are then substituted in condition 6 in Section 2.7 to produce the reduced form estimating equation for P_t. The result of this analysis is to generate an estimate of u, the speed of adjustment parameter, which is assumed to reflect the strength of competitive forces in this market.

Chapter 3

METHODOLOGY

Introduction

This chapter reviews the methods used to derive both aggregated and individual physician fee and use data. Together with Appendices B through F, it covers our Blue Shield and Medicare claims data bases; the service procedures and methods of aggregating into market baskets; bordercrossing and the determination of market areas; estimates of cost-of-living indexes; the physician survey that we have conducted; and the secondary data files.

3.1 BCBSM and Medicare Claims Data Base

The data base was compiled on a claim-specific basis with several data elements for each claim for Medicare B and Blue Shield of Michigan members. A master file was created for services rendered to regular Blue Shield members and complementary Medicare members for the years 1975 - 1980. This file includes information on all professional procedures billed to Blue Shield during those years. A similar master file was created for all beneficiaries of Medicare B for 1979 and 1980, which covers all procedures related to the Medicare population residing in Michigan and a subset of procedures covering 1975 - 1980.

3.1.1 The Blue Shield Data

The following data items were included in the master files for Blue Shield of Michigan from 1975: The BCBSM contract number, relationship to the contract holder (i.e., female spouse, male spouse, or dependent) year of birth of patient; county of residence of the subscriber; total charge for the procedure; total payment for the procedure; number of services; the location of services (office, outpatient, inpatient); the provider's medical specialty; the county in which the provider is practicing; the code for the provider; the code for the procedure and the date of service. Table 3-1 lists the data elements in these files.

Table 3-1

CLAIMS DATA BASE

Tape Layout contains:

- Subscriber's contract number or HIB number
- Subscriber's or Medicare B county code
- BCBSM's or Medicare service code
- BCBSM complementary coverage code
- Patient's relationship code to BCBSM contract holder
- Year of Birth
- Type of service (BCBSM or Medicare)
- Location of service
- Number of services
- Procedures
- Diagnosis
- Date of service
- Charges
- Payments
- Provider's specialty
- Provider's county
- Provider's code
- Pay doctor/pay subscriber code (assignment/non-assignment)

The master file is the source of all information on utilization and fees in the study. This file is massive, containing approximately 50 million records for each year. However, it is also flexible. The data can be analyzed from the prospective of provider, procedure, market area, specialty, and various combinations of these and other variables. Because of this file's size, though, we decided to extract a limited set of procedures along with the corresponding data elements.

The selection process began by reviewing high payout and high frequency procedures for the state as a whole. For surgery and maternity care, procedures were selected that had a Blue Shield frequency of at least 200 during the second quarter of 1979. Procedures were also included with a frequency less than 200 but greater than 50 with an average charge of at least $1,000, or if the frequency was less than 50 but greater than 10 with an average charge of $2,000. For medical care, procedures are included if their frequency was $2,000 or more during the second quarter of 1979.

This process reduced the number of procedures from over 4,000 to 340 surgical, 13 obstetric and 40 medical care procedures, for a total of 384 procedures. In addition, we selected some other procedures as listed in Table 3-2, and described in Appendix B.

Table 3-3 illustrates the comprehensive nature of this file. The 424 procedures represented 56 percent of the services, 60 percent of the payments and 58 percent of the charges billed to Blue Shield of Michigan in 1979. The surgical services in the file represented 90 percent of the surgical services, 74 percent of the surgical payments and 73 percent of the surgical charges.

3.1.2 Total Standardized Output (RVUs) and Fees/RVU

To standardize the heterogeneous services included in our market baskets and to express fees as a measure of a standardized unit of output, the frequency with which every procedure is performed each year is weighted by the 1977 statewide relative charge. Algebraically, the total standardized output (Q^*) in a county or market area for any given year is determined by

$$(1) \qquad Q^* = \Sigma Z_i Q_i$$

where Q_i is the frequency of the ith procedure ($i=1,\ldots,n$) and Z_i is the 1977 statewide relative charge for the ith procedure where our procedure code 9020 (office visit for an established patient--brief service) is assigned a value of one. The resulting quantity can then be interpreted as the total number of 9020 office-visit equivalents and will be referred to as the total number of relative value units (RVUs).

Table 3-2

424 PROCEDURES BY SERVICE TYPE

Type of Service		Number of Procedures
Anesthesia		4
Consultation		3
Maternity		13
Pathology		8
Medical Care		40
Professional Component		8
Psychiatric Care		2
Surgery		340
Diagnostic X-ray		6
	Total	424

Table 3-3

PERCENT of 424

TOTAL SERVICES, CHARGES, AND PAYMENTS

by MARKET BASKET 1979

	% of Services	% of Payment	% of Charges
Surgery	89.78%	73.99%	73.00%
Maternity	96.83	96.76	95.18
Medical Care	71.36	94.69	93.48
Grand Total	56.41	59.63	57.71

Dividing either total payments or charges by Q* will produce two measures of nominal fees, i.e., payments or charges, in terms of $/RVU. That is:

(2) $$P_N = T/Q^*$$

where T is either total payments or total charges.

Equation (2) expresses fees in nominal values. Because it is important to express fees and other monetary variables, e.g., per capita income, in real terms, we have developed a cost-of-living index for each market area for the years 1974-1980 (as described in Section 3.3).

In the aggregated components of this study found in Chapters 4 and 6, our unit of analysis is the market basket. The use index represents the number of RVUs per respective market basket provided to each eligible beneficiary. The price index represents fees per RVU for those services in each respective market basket.

On the other hand, the unit of analysis in the microeconomic samples is the individual physician. Annual fee and use indices were prepared for every physician in each sample. The physician's output index is a measure of the average number of RVUs provided to each unique patient, and the fee indices measure the average fees for the services provided.

3.1.3 The Medicare Data

The same methods described above were used to create comparable Medicare B aggregated and individual physician analytical files. However, because of the gaps in the claims data, we have only developed aggregated indices for 1980 on a group of 311 Medicare procedures that are similar in scope to the 424 Blue Shield procedures described above. (The conversion codes for the two sets of procedures are given in Appendix C.)

However, individual physician indices for the 311 procedures are available for both 1979 and 1980. In addition, we have been able to merge these data with those previously prepared for another study to form a time-series on a more limited set of 56 procedures to cover the entire period 1975-1980. These 56 procedures are also noted in Appendix C. Other limitations, as well as unique additions, to the Medicare data are found in Chapter 6 together with the results of our Medicare analysis.

3.2 Bordercrossing and Market Areas

Central place theory from the economics of location (Losch, 1954 and Isard, 1956) was used to measure patient bordercrossing and determine market areas. A detailed description of our methods is found in Appendix D, but to summarize, the percentages of RVUs residents of a county received from physicians practicing in each county were calculated. These estimates of patient flows were then used to group counties into market areas to identify each market's central-place county. A central-place county is a major provider of care, especially of secondary and tertiary services, to residents of other counties in its market. We have identified 15 markets and their central places, which are numbered and shown in Figure 1-1. Only four central-place counties (2,4,9 and 15) are not in SMSAs. Table 3-8 contains some select characteristics for these market areas.

Although these markets typically account for over 80 percent of the services received by residents within their own respective areas, as seen for surgery in Table 3-4, there is still sufficient residual bordercrossing (among markets) measured by net exports or imports, as we will show, to justify additional adjustments. As our measure of utilization is expressed as the number of RVUs per eligible beneficiary, we have developed also an index that replaces the actual Blue Shield population for each area by an estimate of what we call effective population. Here, for example, if residents of one area receive 10 percent of their RVUs in another area, the latter's effective population is increased by 10 percent of the former's. This adjustment, which is used in aggregated models, has important effects on measures of utilization and estimates of interarea variations in use.

In the individual physician analysis, the index of use measures the intensity with which a physician treats his patient, and it cannot be adjusted as above. Instead, the physician-population ratio is modified by the ratio of actual to effective per capita use. A higher effective rate indicates that, by exporting services to patients living in other market areas, physicians are serving a population larger than the market's actual population, and thus the effective physician-population ratio is diminished.

Table 3-4

PERCENTAGE OF WEIGHTED SURGICAL SERVICES RECEIVED BY RESIDENTS OF A MARKET AREA WITHIN THEIR RESIDENT MARKET AREA: 1979

Market Area	Percentage	Excluding Out-of-State
1	70%	72%
2	83	86
3	85	86
4	72	74
5	89	90
6	88	91
7	87	88
8	62	63
9	77	94
10	81	82
11	75	77
12	82	84
13	83	85
14	70	71
15	78	88

3.3 Cost-of-Living Indices

In time-series analysis, it is clearly important to express monetary variables in real, rather than nominal, dollars. As physicians tend to locate in high cost-of-living areas, it is important also to adjust fees and other monetary variables for geographic cost-of-living differences.

Because cost-of-living deflators were not available for most Michigan counties, we developed our own cost-of-living (COL) index which adjusts for geographic variation at the sub-state level. Following the general methodology developed by the Institute of Medicine (IOM, 1976), the index was constructed in three stages. Briefly, a predictive budget equation was estimated based on available Bureau of Labor Statistics (BLS) urban budget data for 37 SMSA areas (including Detroit). Using regression coefficients from the estimated equation, budgets were then imputed for each of the SMSAs and central-place counties for the remaining market areas that we have identified for Michigan. (All counties within a market area are assigned the same values.) In the final step, county budget estimates were deflated by an average budget estimate for the Detroit SMSA in the base year, yielding a COL index that was then merged onto the physician file. A closer examination of our specific methodology follows.

The Census' Statistical Abstract reports annually the intermediate budgets for a four-person urban household in 39 metropolitan areas. Unfortunately, Detroit is the only Michigan SMSA included, thus requiring that cost-of-living indices be imputed for the other Michigan SMSAs, *viz.*, Muskegon, Battle Creek, Grand Rapids, Lansing, Jackson, Ann Arbor, Bay City, Saginaw and Flint, as well as all non-metro areas.

The BLS breaks down its family budget into four categories: Food (25%), Housing (23%), Transportation (8.4%) and other (44%), with relative shares shown in parentheses. A comparison of low-and high-budget areas show that most of the cost differences are attributable to variation in Housing and Other costs. Housing costs are a function of mortgage and rental rates plus operating expenses, primarily heating. The other category includes such costs as clothing, medical care, and various personal income taxes, suggesting that some specific causal variables should be incorporated into a predictive budget equation, in addition to those specified in earlier work (IOM, 1976).

Thus, the first step in creating the COL index consisted of regressing budget data from 37 SMSAs (Honolulu and Durham, N.C., were dropped for data reasons) on eight explanatory variables, including population size (POP), the percent of the population residing in urban areas (POPURB), per capita income (PCY), the median value of a single family home (HOUSE), median monthly rent (RENT), and per capita taxes collected by local governments (TAX/POP). A simple time dummy variable (T) also was incorporated into the equation to capture intertemporal inflation, along with a time-population interaction term (POP.T) to allow for geographic variation in inflation rates.

The resulting equation can be summarized as follows:

$$(3) \qquad B_{it} = a_o + a_1 POP_{it} + a_2 POPURB_i + a_3 PCY_{it} + a_4 HOUSE_i + a_5 RENT_i + a_6 TAX_i /POP_i + a_7 T + a_8 POP.T + e_{it}$$

where B_{it} = urban intermediate budget in the i-th metro area for a four-person family in year t, and so on. As seen in equation (3) only population size, per capita income, and the two time variables (T and POP.T) are indexed annually. Both the dependent variable and population size are taken from the Statistical Abstracts; annual per capital income estimates come from Sales Management Magazine. The remaining explanatory variables are point-in-time estimates taken from the 1977 County and City Data Book published by the Census.

Equation (3) was estimated in both linear and non-linear (double-log) form from cross-sectional, time-series data on the 37 metropolitan areas listed in the Statistical Abstracts. The time-series was for five years, 1974-1978, yielding a total of 185 observations (37 x 5). Results from the two regressions are presented in Table 3-5. All variables (except time, T) in the non-linear functional form [equation 3] are expressed in natural logs.

Many of the variables were statistically significant, although not always in the expected direction. Per capita income, housing prices, and taxes all added to living costs, but population and rental rates were negatively related, implying lower costs in larger SMSAs, once income, taxes, and other factors were held constant. The non-linear time coefficient implies a seven percent increase in cost-of-living, ceteris paribus. The interaction term was never significant, implying that at least some SMSA inflation rates did not differ systematically with population.

Although both the linear and non-linear equations had significant explanatory power (with R^2s of 0.78 and 0.81, respectively), we chose the latter because it best explained the variance in the dependent variable (budget) and, therefore should have less forecasting error. To determine how closely our estimated equation could predict the actual budget values, and whether the non-linear functional form was, in fact, superior, we tested the two equations on the Detroit SMSA for two years, 1974 and 1976, where we have BLS data. The results indicate that both equations had excellent predictive power. The actual 1974 Detroit budget of $14,390, for example, was estimated at $14,098 using the linear specification (within 2%) and $14,420 using the non-linear specification (within 0.2%), confirming both the strength of the specification and the greater desirability of the non-linear functional form.

Table 3-5

REGRESSION RESULTS FOR LINEAR AND NON-LINEAR BUDGET EQUATIONS

Dependable Variable: SMSA Urban Family Budgets

Independent Variables	Linear (2)	Non-Linear (double log) (3)
POP	-.0003**	-0.09***
POPURB	13.45	-0.06
PCY	0.53**	0.10
HOUSE	0.13***	0.12***
RENT	-18.00**	-0.06
TAX/POP	0.81**	0.10***
TIME	1000.23***	0.07***
POP.T	0.00	-0.02
CONSTANT	9098.24***	8.90***
	R^2 = 0.78	R^2 = 0.81
	$F(8,176)$ = 76.32***	$F(8,176)$ = 96.65***

NOTE: See text for definitions

** significant at 95% confidence level
*** 99% confidence level

	Detroit Predicted Budget	Detroit Actual Budget (from BLS data)
1974: Linear	$ 14,098	$ 14,390
Non-Linear	14,420	
1976: Linear	16,106	16,514
Non-Linear	16,566	

The second step in index construction required that budgets be imputed for the remaining ten Michigan SMSAs, and all the non-SMSA central place counties. All the counties within a given metropolitan area (SMSA) are assumed to have the same cost-of-living; thus, they are assigned the same budget estimate. As data were unavailable for HOUSE and RENT variables in the Battle Creek SMSA, it was treated as a non-metropolitan area. Similarly, all counties with a non-SMSA central place are assigned the same budget as the central place county. Three counties (Ionia, Lapeer and Livingston) that are in SMSAs belong to other medical-market areas with a non-SMSA central place. They were assigned their respective central place budgets. Using coefficients from equation (3), budget estimates were imputed by plugging in values for each independent variable at the SMSA or county level. Again, the Statistical Abstracts, City and County Data Book (1977), and Sales Management Magazine provided the necessary data.

Employing the same predicting equation, based solely on urban data, to both SMSA and non-SMSA areas presumes that a similar set of variables explains cost-of-living in urban and rural areas alike. In the absence of contradictory evidence, and for the sake of consistency, this seems a reasonable assumption to make.

After the generation of annual budget estimates for the 83 Michigan counties and 15 market areas over the 1974-80 period, the final step in constructing the COL index was to deflate each estimate by a base budget. The base chosen was the 1974 budget for the Detroit SMSA; thus, all physician fees, wage rates, etc., adjusted by the COL index will be expressed relative to prices in the Detroit area in 1974. These market-area deflators for 1975-80 are shown in Table 3-6. Adjusting all monetary variables for cost-of-living will yield direct comparability across geographic areas.

Table 3-6

COST-OF-LIVING INDEXES FOR

15 MARKET AREAS: 1975 - 1980

Market	Central Place	1975	1976	1977	1978	1979	1980
1	Bay	1.01	1.08	1.16	1.23	1.38	1.50
2	Emmet	1.05	1.12	1.21	1.30	1.40	1.51
3	Genesee	1.02	1.08	1.16	1.24	1.43	1.53
4	Grand Traverse	1.05	1.12	1.20	1.29	1.39	1.49
5	Ingham	1.03	1.10	1.17	1.25	1.45	1.56
6	Kalamazoo	1.03	1.10	1.17	1.25	1.39	1.51
7	Kent	1.03	1.09	1.17	1.25	1.37	1.48
8	Macomb	1.09	1.15	1.21	1.33	1.48	1.60
9	Marquette	0.95	1.02	1.10	1.18	1.28	1.38
10	Muskegon	0.98	1.04	1.12	1.19	1.32	1.43
11	Oakland	1.09	1.15	1.21	1.33	1.48	1.60
12	Saginaw	1.02	1.09	1.17	1.25	1.42	1.52
13	Washtenaw	1.08	1.15	1.21	1.33	1.48	1.60
14	Wayne	1.09	1.15	1.21	1.33	1.48	1.60
15	Berrien	1.04	1.12	1.19	1.30	1.40	1.52
State:		1.07	1.13	1.20	1.30	1.46	1.57

Note: The State values are weighted (by total RVUs) averages of the market indexes. Detroit (1974) has the base value of 1.00.

3.4 Physician Specialities

Because our claims file is aggregated by geomedical units, we have fee and output information also for four specialty groups for every market area. These specialty groups and their relationship to the GMENAC classification are shown in Table 3-7.

Our data will thus permit a comparison of fee levels and their growth rates for any market basket across specialties as well as any inter-market differences that may exist between our specialty groupings.

3.5 Secondary Data Files

Appendix E describes all of the secondary data items available to the project along with the source and years available. These data were collected at the county level, allowing great flexibility in aggregation.

In terms of population characteristics, the usual demographics are available, including total population, age-sex-race distribution, population density, education and SMSA-Non-SMSA location. Numbers and distributions are available also on BCBSM and Medicare subscribers separately. In addition, extensive data has been collected on Michigan's health resources including physicians, hospitals, nursing homes, outpatient clinics, and medical school facilities. Finally, several measures of income and wages were obtained.

Table 3-8 shows the 1980 market area values for selected characteristics in addition to population, which has a very wide range. Table 3-8 includes the percent of the population covered by Medicare, BCBSM penetration (a key insurance variable and of specific interest to BCBSM), and real per capita income. Our measure of income is "Effective Buying Power," as reported by Sales and Marketing Management annually in their July issue.

Table 3-7

DISTRIBUTION OF BCBSM SPECIALTY CODES ACCORDING TO GMENAC* CATEGORIES

I. Primary Care

01	General Practice	03	Allergy
08	Family Practice	12	Manipulative
35	Pediatrics	70	(Clinic)
11	Internal Medicine		

II. Other Medical Specialties

07	Dermatology	10	Gastroenterology
	Pediatric Cardiology	29	Pulmonary Disease
06	Cardiovascular Disease		

III. Surgical Specialties

02	General Surgery	24	Plastic Surgery
14	Neurological Surgery	28	Proctology/Colon & Rectal Surgery
16 (MD)	OB/GYN	33	Thoracic Surgery
09 (DO)		34	Urology
15			
18 (MD)	Ophthalmology	19	Dental Surgery
20	Orthopedic Surgery		
04 (MD)	Otolaryngology/		
17 (DO)	Otorhinolaryngology		

IV. Other Remaining Specialties

05	Anesthesiology	39	Preventive Medicine
13 (MD)	Neurology	95	Chiropractic Medicine
22 (MD)	Pathology/Pathologic	48	Podiatric Medicine
21 (DO)	Anatomy	64	Audiologist
26 (MD)	Psychiatry	90	Optometrist
27 (DO)		62	(Psychologist)
25	Physical Medicine and Rehabilitation	66	(Hospital)
		69	(Laboratory)
30	Radiology/Roentgenology	00	
31	Diagnostic Radiology	63	Unknown
32	Therapeutic Radiology	85	

*Graduate Medical Education National Council

Table 3-8

SELECTED MARKET AREA

CHARACTERISTICS FOR 1980

-------------Market Area------------- Central Place County	(Major City)	Total Population	Medicare/ Population Ratio	BCBSM/ Population Ratio	Physicians/ 10,000 Population	Real Per Capita Income
1. Bay	(Bay City)	215,831	12.2	46.5	8.5	4,473
2. Emmet	(Petoskey)	181,562	14.6	40.6	11.3	3,679
3. Genesee	(Flint)	632,416	8.3	68.6	11.9	5,344
4. Grand Traverse	(Traverse City)	198,084	14.1	38.5	16.9	3,777
5. Ingham	(Lansing)	416,667	7.6	42.6	14.8	5,603
6. Kalamazoo	(Kalamazoo)	566,519	10.3	25.9	11.6	4,803
7. Kent	(Grand Rapids)	926,903	10.1	30.8	10.5	4,541
8. Macomb	(Warren)	833,402	8.2	53.9	10.1	5,535
9. Marquette	(Marquette)	280,550	14.5	22.4	9.4	3.973
10. Muskegon	(Muskegon)	205,956	11.4	28.5	12.3	4,098
11. Oakland	(Pontiac)	1,011,793	8.8	69.2	22.9	7,319
12. Saginaw	(Saginaw)	496,935	9.3	42.5	10.1	4,815
13. Washtenaw	(Ann Arbor)	648,551	8.0	45.6	14.1	4,971
14. Wayne	(Detroit)	2,471,899	9.9	60.3	13.3	5,508
15. Berrien	(St. Joseph)	171,276	11.5	17.2	10.6	4,065

NOTE: Real per capita income is expressed in terms of 1974 Detroit area dollars.

3.6 Physician Survey

In September, 1981, 12,500 questionnaires were mailed to Michigan physicians (MDs and DOs), including any physician who submitted claims to Blue Cross and Blue Shield of Michigan over a one year period beginning September, 1980. The questionnaire (Appendix F) was designed to collect information on physician and practice characteristics to complement the Blue Shield and Medicare claims data files. We were especially interested in collecting two kinds of physician-reported data. First, as discussed in Chapter Two, to test .the proposed inducement model, it would be useful to have information that is unavailable in either the claims data files or our secondary data sources. This category would include data on various amenities such as waiting times and length of visit. Second, we wanted additional fee and insurance information.

The fee data to be used in this project were taken directly off BCBSM/Medicare billing forms. In using this data, it must be assumed that the fees (a) represent average charges to <u>all</u> patients, not just BCBSM/Medicare patients, and (b) reduced fees and bad debts are either insignificant or unrelated to physician densities. While these assumptions are probably correct to a first approximation, it would strengthen the project to have corroboration of these assumptions. If systematic differences are found, the results can be used to adjust reported fees in ways described above.

Insurance coverage has repeatedly been found in empirical studies of health care demand to be significant. As coverage should be positively correlated with physician densities, it is crucial that this variable, in particular, be accurately measured. Fortunately, BCBSM/Medicare penetration is very high in Michigan which greatly reduces the problem of measuring insurance coverage. Still, Medicare coverage and some commercial coverage will be disproportionately more important in some geographic areas. Asking physicians directly the percentage of patients covered by various types of insurance coverage provided the missing information.

The response rate to the questionnaire was approximately 17 percent (over 2,100 physicians), with usable information presents on 2,070 physicians. The data, tabulated by market area in Tables F.1 through F.7 in Appendix F are discussed in Cromwell, et al. (1983).

Chapter 4

AGGREGATED BLUE SHIELD ANALYSIS

Introduction

This Chapter examines aggregated market area fee and utilization indices for Blue Shield beneficiaries. The use indices are expressed as the number of RVUs per eligible population and were derived using the methods described in Chapter 3. Both nominal and real fee indices are included here. Comparisons of Blue Shield fee and use indices derived from claims data of individual physicians are taken up in Chapter 5. In addition, we provide econometric tests of the inducement hypotheses through estimates of empirical specifications of equations (4) and (6) found in Chapter 2, Section 2.6.

4.1 Physician Fees

Table 4-1 shows the aggregated market area fee and use indices for the 424 procedures reviewed for 1980. (Percentage changes between 1975 and 1980 are given in parentheses.) The corresponding data for the surgical, medical care and obstetric sub-baskets are found in Tables 4-2 through 4-4, respectively.

4.1.1 Nominal and Real Charges per RVU

The statewide mean growth rate for nominal charges between 1975 and 1980 ranged from 55 percent for obstetrics to 69 percent for medical care, and averaged 59 percent for all 424 procedures. While nominal fees appear to have grown rapidly, real fees for all procedures have grown only eight percent since 1975 and not shown in Table 4-1, only 1.5 percent since 1977. However, the state averages obscure large interarea differences. For example, the growth in real charges ranged from five to sixteen percent in Lansing and Petoskey, respectively.

Compared to utilization, though nominal charges per RVU have much less variation as indicated by the coefficients of variation (CV) and by fee ranges. This dispersion is even further reduced once the cost-of-living adjustments are introduced. The respective CVs fall by approximately one-quarter and the differential between the major urban and other areas are similarly reduced. Nevertheless, the Detroit

Table 4-1

USE AND FEES IN 1980 AND

PERCENT CHANGES: 1975 - 1980

424 PROCEDURES

Market Area Major City	Total RVUs Per 1,000 Actual Population	Total RVUs Per 1,000 Effective Population	Nominal Charge Per RVU	Real Charge Per RVU	Real Payment Per RVU	Physician Per 10,000 Population 1980
1. Bay City	4,807 (5)	5,538 (20)	14.25 (63)	9.52 (11)	7.52 (4)	8.5
2. Petoskey	4,196 (20)	4,357 (15)	13.48 (67)	8.93 (16)	7.14 (9)	11.3
3. Flint*	7,362 (50)	7,732 (53)	15.06 (65)	**9.86** (10)	7.52 (-2)	11.9
4. Trav. City	4,067 (2)	4,526 (11)	12.87 (60)	8.66 (13)	7.00 (6)	16.9
5. Lansing	6,251 (30)	5,495 (25)	13.54 (59)	8.69 (5)	7.01 (-1)	14.8
6. Kalamazoo	4,695 (11)	4,345 (18)	13.16 (57)	8.70 (7)	6.94 (2)	11.6
7. Gr. Rapids	4,487 (22)	4,591 (23)	12.65 (58)	8.54 (10)	7.12 (5)	10.5
8. Warren*	7,470 (24)	8,000 (27)	15.47 (62)	9.67 (11)	7.22 (-2)	10.1
9. Marquette	**2,394** (-27)	**2,799** (-15)	12.56 (55)	9.08 (6)	**7.58** (8)	9.4
10. Muskegon	4,708 (27)	4,709 (33)	13.11 (62)	9.19 (12)	7.30 (3)	12.3
11. Pontiac*	**11,195** (47)	**8,067** (41)	15.32 (56)	9.58 (6)	7.20 (-4)	22.8
12. Saginaw	5,539 (21)	5,175 (27)	13.23 (60)	8.70 (7)	7.25 (4)	10.1
13. Ann Arbor	7,463 (43)	6,237 (46)	14.16 (60)	8.90 (9)	6.89 (4)	14.1
14. Detroit*	6,715 (32)	7,931 (50)	**15.59** (60)	9.75 (9)	7.07 (-3)	13.3
15. St. Joseph	3,282 (37)	3,766 (54)	**12.30** (55)	**8.15** (7)	**6.77** (7)	10.6
State Mean	6,892 (38)	6,892 (38)	14.91 (59)	9.47 (8)	7.18 (-2)	13.4
Market Mean Area	5,642 (25)	5,551 (30)	13.78 (60)	9.06 (9)	7.17 (2)	12.5
Coefficient of Variation	38.6	30.3	8.1	5.7	3.3	28.7

NOTE: The percent changes between 1975 and 1980 are given in parentheses; real values are expressed in 1974 Detroit area dollars. The * indicates high Blue Cross-Blue Shield penetration rate--high income markets. Minimum and maximum values are darkened.

Table 4-2

USE AND FEES IN 1980 AND

PERCENT CHANGES: 1975 - 1980

340 SURGICAL PROCEDURES

Market Area Major City	Total RVUs Per 1,000 Actual Population	Total RVUs Per 1,000 Effective Population	Nominal Charge Per RVU	Real Charge Per RVU	Real Payment Per RVU	Physician Per 10,000 Population 1980
1. Bay City	2,283 (4)	2,698 (22)	14.57 (66)	9.73 (13)	7.64 (9)	8.5
2. Petoskey	2,184 (34)	2,145 (22)	13.28 (67)	8.80 (16)	7.12 (7)	11.3
3. Flint*	3,142 (45)	3,352 (48)	15.26 (68)	9.99 (12)	7.56 (2)	11.9
4. Trav. City	2,049 (3)	2,328 (12)	12.69 (67)	8.54 (18)	7.00 (9)	16.9
5. Lansing	3,364 (28)	2,799 (19)	13.69 (60)	8.78 (6)	7.06 (0)	14.8
6. Kalamazoo	2,240 (9)	2,064 (12)	13.19 (62)	8.72 (10)	7.11 (5)	11.6
7. Gr. Rapids	2,412 (20)	2,416 (21)	12.67 (62)	8.55 (13)	7.21 (8)	10.5
8. Warren*	4,104 (31)	4,133 (28)	15.94 (67)	**9.97** (14)	7.31 (1)	10.1
9. Marquette	1,178 (-24)	1,312 (-18)	11.97 (62)	8.66 (11)	7.34 (9)	9.4
10. Muskegon	2,255 (37)	2,232 (37)	13.36 (71)	9.37 (18)	7.46 (7)	12.3
11. Pontiac*	5,554 (43)	4,075 (41)	15.68 (60)	9.80 (9)	7.33 (-2)	22.8
12. Saginaw	2,565 (14)	2,361 (18)	13.20 (65)	8.68 (11)	7.28 (8)	10.1
13. Ann Arbor	3,412 (39)	2,924 (44)	14.25 (65)	8.96 (12)	6.99 (2)	14.1
14. Detroit*	3,325 (35)	3,891 (52)	15.83 (65)	9.90 (13)	6.97 (-2)	13.3
15. St. Joseph	1,581 (41)	1,712 (51)	12.62 (56)	**8.37** (8)	6.98 (8)	10.6
State Mean	3,384 (38)	3,384 (38)	15.15 (64)	9.65 (12)	7.22 (-1)	13.4
Market Mean Area	2,777 (24)	2,699 (27)	13.88 (64)	9.12 (12)	7.22 (5)	12.5
Coefficient of Variation	39.1	31.3	9.3	6.6	3.0	28.7

NOTE: The percent changes between 1975 and 1980 are given in parentheses; real values are expressed in 1974 Detroit area dollars. The * incidates high Blue Cross-Blue Shield penetration rate--high real income markets. Minimum and maximum values are darkened.

Table 4-3

USE AND FEES IN 1980 AND

PERCENT CHANGES: 1975 - 1980

40 MEDICAL CARE PROCEDURES

Market Area Major City	Total RVUs Per 1,000 Actual Population	Total RVUs Per 1,000 Effective Population	Nominal Charge Per RVU	Real Charge Per RVU	Real Payment Per RVU	Physician Per 10,000 Population 1980
1. Bay Ciy	1,362 (15)	1,508 (28)	13.55 (78)	9.05 (20)	7.38 (13)	8.5
2. Petoskey	1,115 (0)	1,182 (3)	13.93 (91)	9.23 (32)	7.41 (31)	11.3
3. Flint*	2,139 (65)	2,210 (70)	14.60 (73)	9.56 (15)	7.53 (5)	11.9
4. Trav. City	1,111 (2)	1,194 (11)	13.33 (81)	8.97 (28)	7.36 (24)	16.9
5. Lansing	1,282 (34)	1,184 (32)	13.15 (63)	8.44 (8)	7.05 (5)	14.8
6. Kalamazoo	1,220 (9)	1,130 (23)	13.27 (67)	8.78 (14)	6.87 (11)	11.6
7. Gr. Rapids	939 (24)	1,006 (23)	12.44 (60)	8.40 (11)	6.92 (9)	10.5
8. Warren*	1,649 (25)	1,924 (36)	15.00 (67)	9.38 (14)	7.25 (2)	10.1
9. Marquette	689 (-32)	836 (-15)	13.05 (68	9.44 (15)	7.98 (23)	9.4
10. Muskegon	1,465 (27)	1,388 (33)	13.03 (67)	9.13 (15)	7.16 (9)	12.3
11. Pontiac*	2,535 (67)	1,939 (54)	14.98 (68)	9.37 (14)	7.22 (3)	22.8
12. Saginaw	1,499 (27)	1,433 (39)	13.58 (77)	8.93 (20)	7.42 (16)	10.1
13. Ann Arbor	1,876 (61)	1,522 (58)	15.36 (82)	9.65 (23)	7.16 (6)	14.1
14. Detroit*	1,754 (35)	2,005 (56)	15.64 (66)	9.78 (13)	7.35 (3)	13.3
15. St. Joseph	857 (38)	1,127 (70)	11.44 (52)	7.58 (5)	6.48 (10)	10.6
State Mean	1,729 (46)	1,729 (46)	14.87 (69)	9.47 (15)	7.35 (6)	13.4
Market Mean Area	1,432 (26	1,439 (35)	13.76 (71)	9.05 (17)	7.24 (11)	12.5
Coefficient of Variation	34.7	28.5	8.4	6.3	4.7	28.7

NOTE: The percent changes between 1975 and 1980 are given in parentheses; real values are expressed in 1974 Detroit area dollars. The * indicates high Blue Cross-Blue Shield penetration rate--high real income markets. Minimum and maximum values are darkened.

Table 4-4

USE AND FEES IN 1980 AND

PERCENT CHANGES: 1975 - 1980

13 OBSTETRIC PROCEDURES

Market Area Major City	Total RVUs Per 1,000 Actual Population	Total RVUs Per 1,000 Effective Population	Nominal Charge Per RVU	Real Charge Per RVU	Real Payment Per RVU	Physician Per 10,000 Population 1980
1. Bay City	424 (9)	433 (14)	13.36 (73)	8.92 (17)	7.72 (9)	8.5
2. Petoskey	400 (61)	402 (44)	12.65 (59)	8.38 (10)	7.29 (6)	11.3
3. Flint*	558 (33)	573 (33)	13.83 (72)	9.06 (15)	7.74 (8)	11.9
4. Trav. City	383 (23)	403 (36)	13.23 (72)	8.90 (21)	7.33 (9)	16.9
5. Lansing	610 (24)	567 (35)	14.07 (53)	9.03 (1)	7.47 (-4)	14.8
6. Kalamazoo	460 (20)	431 (27)	13.35 (59)	8.83 (9)	7.47 (3)	11.6
7. Gr. Rapids	508 (37)	495 (34)	12.03 (52)	8.12 (5)	7.49 (6)	10.5
8. Warren*	515 (-8)	502 (15)	14.13 (59)	8.84 (8)	7.34 (-1)	10.1
9. Marquette	271 (-20)	306 (-7)	12.71 (63)	9.19 (11)	8.09 (13)	9.4
10. Muskegon	429 (34)	419 (43)	12.05 (54)	8.45 (6)	7.68 (7)	12.3
11. Pontiac*	674 (53)	499 (28)	15.18 (50)	8.49 (2)	7.54 (-9)	22.8
12. Saginaw	553 (18)	470 (34)	12.89 (46)	8.47 (-2)	7.58 (2)	10.1
13. Ann Arbor	613 (31)	525 (35)	13.19 (51)	8.29 (3)	7.13 (-5)	14.1
14. Detroit*	421 (24)	506 (40)	15.29 (54)	9.56 (5)	7.58 (-4)	13.3
15. St. Joseph	429 (49)	411 (49)	12.07 (46)	8.00 (1)	7.09 (1)	10.6
State Mean	496 (31)	496 (31)	14.25 (55)	9.08 (6)	7.52 (-1)	13.4
Market Mean Area	483 (26)	463 (31)	13.34 (58)	8.77 (8)	7.50 (3)	12.5
Coefficient of Variation	21.9	15.4	7.7	5.4	3.4	28.7

NOTE: The percent changes between 1975 and 1980 are given in parentheses; real values are expressed in 1974 Detroit area dollars. The * indicates high Blue Cross-Blue Shield penetration rate--high real income markets. Minimum and maximum values are darkened.

metropolitan area, including Flint, continues to have the highest real charges, while St. Joseph consistently has the lowest real charges.

As for comparisons in fees among the three sub-baskets, charges for medical care have increased the fastest followed by those for surgery with those for obstetrics lagging considerably.[1] In several markets, however, the rankings of surgery and medical care are reversed. In real terms, the statewide growth ranking is preserved and, in some markets, charges for surgery have again grown faster than those for medical care.

4.1.2 Specialty Groups

Table 4-5 contains information on nominal and real charges for all 424 procedures in 1980 for four specialty groupings.[2] The surgical specialties show the highest charges, per RVU both nominal and real; while other remaining specialties have the lowest fees, not only in terms of averages (11.2 percent less than surgery), but in most individual markets. Similar patterns are found for real charges.

Like our market basket findings, there are large interarea variations in fees also, although they are not reduced as much by cost-of-living adjustments. Moreover, there are large differences in the size of the interarea variations between specialties. For example, for real charges, the CV for surgery is just over one-third the CV for other medical specialties. In part, this reflects an increasing likelihood of outliers given the concentration of specialists in the major metropolitan areas and the relatively small number in some of the sparsely populated market areas.

4.1.3 Fees and Area Characteristics

Table 4-6 shows both the nominal and real charges per RVU in 1980 for each market basket cross-tabulated by market area groupings of three secondary variables of interest. These are the physician-population ratio (the focus of the overall study), the Blue Cross-Blue Shield rate of penetration, i.e., proportion of the population covered by Blue Cross-Blue Shield, and real per capita income.

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[1] Because the weighting procedure produces the same statewide fee per RVU for each market basket in 1977 ($11.18 per RVU), only the statewide growth rates and not the levels, themselves, are directly comparable.

[2] The micro data in Chapters 5 and 6 are grouped by specialty, and more detailed descriptive analyses are found there.

Table 4-5

NOMINAL AND REAL CHARGES PER RVU FOR

FOUR SPECIALTY GROUPS FOR 1980:

MARKET BASKET "GRAND TOTAL"

Market Area	Nominal Charges Per RVU				Real Charges Per RVU			
Major City	1	2	3	4	1	2	3	4
1. Bay Ciy	13.66	11.85	15.27	13.83	9.12	7.91	10.20	9.23
2. Petoskey	13.62	**17.00**	14.04	11.66	9.02	**11.26**	9.30	7.73
3. Flint*	14.80	15.40	16.07	14.24	**9.69**	10.08	10.52	9.32
4. Traverse City	12.74	**8.33**	14.22	11.30	8.57	**5.60**	9.57	7.60
5. Lansing	13.08	12.19	15.21	12.13	8.39	7.82	9.76	7.78
6. Kalamazoo	12.71	11.57	14.26	12.25	8.41	7.65	**9.43**	8.10
7. Grand Rapids	12.25	11.50	**13.55**	11.83	8.27	7.76	9.14	7.98
8. Warren*	15.13	15.92	16.66	14.28	9.46	9.95	10.42	8.93
9. Marquette	11.73	11.54	13.93	12.71	8.48	8.34	10.07	9.19
10. Muskegon	12.56	12.17	14.57	11.77	8.80	8.53	10.21	8.25
11. Pontiac*	14.91	15.19	16.48	14.40	9.32	9.50	10.30	9.00
12. Saginaw	13.01	13.81	14.24	11.56	8.55	9.08	9.36	7.60
13. Ann Arbor	14.55	15.57	14.44	13.16	9.14	9.78	9.07	8.27
14. Detroit*	**15.44**	14.83	**16.85**	**14.91**	9.65	9.27	**10.54**	9.32
15. St. Joseph	11.52	11.93	13.61	**10.63**	7.64	7.91	**9.02**	**7.05**
State Mean	14.62	14.82	15.94	14.15	9.28	9.41	10.12	8.99
Market Mean Area	13.45	13.25	14.80	12.71	8.83	8.70	9.80	8.36
Coefficient of Variation	9.4	17.7	7.6	10.5	6.5	15.8	5.7	9.0

NOTE: 1 = Primary Care; 2 = Other Medical Specialties; 3 = Surgical Specialties; 4 = Other Remaining Specialties. The * indicates high Blue Cross-Blue Shield penetration rate--high real income markets. The minimum and maximum values in each column are darkened.

The most striking feature in Table 4-6 is the unusual relationship between physician density and fees. Ignoring the low density group, the relationship is consistent with findings in most other studies. Both real and nominal charges increase with higher physician-population ratios, although the difference in real charges of less than three percent for Grand Total is markedly narrower than the difference in nominal charges which is over eight percent. Fees in markets with the lowest concentration rate appear to be comparable to those in the highest two categories. The reason for this result is that two of the markets in the low grouping, Bay City and Warren share a pattern similar in fees and utilization to an adjacent major metropolitan area but are net importers of services. If Warren were included with the Detroit or Pontiac markets, and Bay City with Saginaw, the nonlinear pattern in price would be eliminated.

While a positive relationship emerges between fees and physician densities -- a finding that on the surface appears to contradict neoclassical predictions -- the rate of change between 1975 and 1980 is consistent with traditional economic theory. The simple correlation coefficients between physician concentration and the growth in both nominal and real charges are -0.23 and -0.18, respectively.

More striking, however, are the findings for the other two variables, insurance coverage and per capita income. There are strong positive relationships between fees and both the BCBSM penetration rate and real per capita income. Markets with the highest penetration rates have nominal charges that are twenty percent higher for all 424 procedures than areas with the lowest penetration rates. Real fees are twelve percent higher. Nominal and real fees were seventeen and eighteen percent higher in high vs. low income areas, respectively. These patterns are fairly uniform across market baskets.

Table 4-6

NOMINAL AND REAL CHARGES PER RVU
FOR 1980 FOR FOUR MARKET BASKETS
BY SELECTED AREA CHARACTERISTICS

Variable (No. of Markets)	Nominal Charges Per RVU				Real Charges Per RVU			
	OB	MC	S	GT	OB	MC	S	GT
Physician-Population Ratio								
Low (3)	13.43	14.69	15.65	15.21	8.87	9.33	9.89	9.63
Low-Medium (5)	13.04	13.96	14.07	14.07	8.62	8.77	9.29	9.28
High-Medium (5)	14.57	15.26	15.25	15.05	9.20	9.61	9.60	9.47
High (2)	15.07	14.90	15.56	15.23	9.46	9.35	9.75	9.54
BCBSM Penetration Rate								
Low (5)	12.41	12.77	12.83	12.82	8.37	8.66	8.68	8.67
Medium (6)	13.29	14.21	13.80	13.74	8.58	9.17	8.85	8.90
High (4)	14.86	15.21	17.74	15.42	9.36	9.57	9.89	9.70
Real Per Capita Income								
Low (5)	12.61	13.30	12.41	13.00	8.61	9.03	8.82	8.87
Medium (5)	12.86	14.01	13.56	13.53	8.40	9.10	8.84	8.81
High (5)	14.81	15.14	15.64	15.25	9.34	9.53	9.84	9.60

NOTE: L = Low; M = Medium; H = High; LM = Low Medium; and HM = High Medium. For Physicians/10,000 Population: L = < 10, LM = 10-12; HM = 12-16, and H = > 16. For BCBSM Penetration Rate: L = < 38, M =38-47 and H = > 53. For Real Per Capita Income: L = $3600-$4100, M = $4400-$5000, and H => $5300.

4.2 Utilization

The data in Tables 4-1 through 4-4 included two utilization measures. (Summary statistics for the four market baskets are given in Table 4-7.) One shows the total standardized quantity per 1,000 actual BCBSM population; while the other adjusts for residual bordercrossing between markets to provide an index of use per 1,000 effective BCBSM population. The effects of this adjustment are in some cases quite striking. For example, Table 4-1 shows that in 1980 areas 11 (Pontiac) and 13 (Ann Arbor) exported thirty-nine percent and twenty percent of the net services consumed in their respective markets, while 14 (Detroit) imported (net) fifteen percent of its services for residents seeking physician care elsewhere. Thus, one can conclude that significant bordercrossing persists among markets and that a failure to deal with this phenomenon can produce substantial distortion in rates of utilization.

Despite our adjustment for residual bordercrossing, there remains substantial interarea variation in both the levels and rates of growth in utilization. It is, in fact, the higher income, urbanized areas with high levels of use that have also experienced the largest increases in use. This explains why the overall State increases are so large for every market. Given our previous analysis of fees which showed very little overall change in real terms, it is clear that utilization primarily has been responsible for the rapid escalation of real expenditures.

4.2.1 Utilization and Selected Area Characteristics

Table 4-8 shows the actual and effective rates of utilization for 1980 for each market basket cross-tabulated by the same area characteristics used previously. As before, a nonlinear relationship between MD/POP and use emerges. Following our earlier discussion, if the low density group is treated as an anomaly, there is unequivocally a strong positive relationship between MD/POP and utilization, even after correction for bordercrossing between markets. Effective utilization for all procedures in the high density areas in 1980 was 31 percent higher (79 percent for actual utilization) than in the low-medium markets. Much of this difference is found in surgery, much less in medical care, but none in obstetrics. Not only is use highest in areas rich in physicians, but the growth rate in effective utilization between 1975 and 1980 is highest there also.

Table 4-7

SUMMARY UTILIZATION DATA FOR

FOUR MARKET BASKETS FOR 1980

Market	Utilization Per 1,000 Actual BCBSM Population				Utilization Per 1,000 Effective BCBSM Population					
	M.A. Mean	Min.	Max.	C.V.	M.A. Mean	Min.	Max.	C.V.	State Mean	% Change 1975-1980
Grand Total	5642	2394	11195	38.6	5551	2799	8067	30.3	6892	38
Surgery	2777	1178	5554	39.1	2700	1312	4133	31.3	3383	38
Medical Care	1432	689	2535	34.7	1439	836	2210	28.5	1729	46
Obstetrics	483	272	674	21.9	63	306	573	15.4	496	31

NOTE: State means and percentage changes between 1975 and 1980 are the same for both utilization measures.

Table 4-8

ACTUAL AND EFFECTIVE UTILIZATION RATES FOR 1980 FOR FOUR MARKET BASKETS BY SELECTED AREA CHARACTERISTICS

Variable (No. of Markets)	Utilization Per 1,000 Actual BCBSM Population				Utilization Per 1,000 Effective BCBSM Population			
	OB	MC	S	GT	OB	MC	S	GT
Physician-Population Ratio								
Low (3)	475	1504	3505	6513	473	1745	3654	7118
Low-Medium (5)	528	1566	2702	5849	511	1621	2740	5958
High-Medium (5)	442	1688	3238	6588	481	1760	3425	7023
High (2)	645	2395	5210	10490	492	1885	3960	7813
BCBSM Penetration Rate								
Low (5)	459	1031	2178	5519	449	1072	2163	4331
Medium (6)	543	1501	2882	5978	492	1390	2659	5541
High (4)	511	1971	3917	7936	512	2003	3912	7957
Real Per Capita Income								
Low (5)	379	1100	1895	3798	389	1197	2012	4117
Medium (5)	532	1860	2691	6141	485	1322	2534	5277
High (5)	557	1923	3890	7890	516	1934	3840	7851

NOTE: L = Low; M = Medium; H = High; LM = Low Medium, and HM = High Medium. For Physicians/10,000 population: L =< 10, LM = 10-12; HM = 12-16, and H = > 16. For BCBSM Penetration Rate: L = < 38, M = 38-47 and H = > 53. For Real Per Capita Income: L = \$3600-\$4100, M = \$4400-\$5000, and H = > \$5300.

However, before we conclude that physicians induce demand, note that the effects of insurance and income are even greater. There are strong positive relationships between use and the BCBSM penetration rate and real per capita income, respectively. Effective utilization overall (Grand Total) was eighty-four percent greater in high versus low penetration areas, with large differences observed for both medical care and surgery. Tables 4-1 showed also that between 1975 and 1980, growth in high penetration markets like Detroit was markedly greater than that in the low penetration group.

Similarly, the levels and rates of growth in effective use are much higher across the board, including OB, in high than in low income areas. In 1980, effective use was 91 percent higher in the high than in the low income group.

We should emphasize that these findings for insurance and income levels are not due to differences in the scope of Blue Shield coverage in different areas or changes in coverage over time. For the procedures that we are examining, coverage is virtually uniform across the various Blue Shield plans.

4.3 Summary and Discussion

Analysis of the rate of increase in physicians' fees, adjusted for the cost-of-living, yields relatively little overall change in real fees from 1975 to 1980. Changes in utilization, however, range from 31 to 46 percent per 1,000 covered population over the same period for the market baskets included in the study. Thus the growth in use is clearly the major driving force behind the escalation in real expenditures for physician care.

4.3.1 Fees

Although nominal charges have been growing at rapid rates, e.g., 59 percent for all 424 procedures included between 1975 and 1980, virtually all of this results from increases in the overall cost-of-living. The statewide real increase in fees was only eight percent between 1975 and 1980 and less than two percent since 1977. To the extent that inflation is moderating currently, one can expect nominal charges to moderate also.

Looking at individual market data, one finds high interarea variations in both the levels and rates of growth in charges. As we have shown, however, approximately one-fourth of the variation in fee levels can be attributed to cost-of-living differentials. One of the major goals of the overall project is to account for the remaining differences in fee levels and their rates of growth.

In addition to this impact on inter-market variations in fees, cost-of-living adjustments also narrow fee differentials across market baskets. For example, the market area mean nominal growth for surgery exceeded that for obstetrics by nine percent as compared to a difference of six percent in real terms. Although fee growth has been fairly uniform across market baskets, however, there are major differences across specialty groupings. The surgical specialties' real charges per RVU, generally the highest in every market, exceed those for other remaining specialties by thirteen percent in 1980 in both real and nominal terms.

Perhaps of greatest interest and relevance, however, are the findings on relationships between market area characteristics and fees and utilization. After accounting for certain anomalies in the low physician-density group, we have found positive relationships between physician concentration and both nominal and real fees. However, for all 424 procedures, real charges in the high density areas in 1980 were less than three percent higher than in the low-medium grouping. Thus, the positive relationship between physician density and fees is not especially marked.

Much stronger relationships with fees were observed for both the Blue Cross-Blue Shield penetration rate and real per capita income. Real fees for all procedures in 1980 were twelve and eight percent

higher in high vs. low penetration and high vs. low income markets, respectively.

4.3.2 Utilization

We have found that substantial bordercrossing exists among some markets and that a failure to deal with the residual bordercrossing could seriously distort rates of use. In 1980, one market, Pontiac, exported 39 percent of its services, while four markets, including Detroit, imported over ten percent. Not surprisingly, then, our adjustment for bordercrossing significantly reduced apparent interarea differences in utilization. Despite this adjustment, however, large interarea differences remain in both use and growth in use.

For the state as a whole, we were struck by the unusually high growth in output (31 to 46 percent across the market baskets) over such a short time span. Growth in use is clearly the driving force behind the escalation in real expenditures for physician care in Michigan.

As for factors that may be contributing to this growth, we have looked at simple cross-tabulations with physician density. Again after the elimination of several unusual markets, there appears to be a strong positive relationship between physician density and use, with much of it attributable to the set of surgical procedures.

More obvious, however, are the extraordinary differences in use between high and low BCBSM penetration markets and between high and low income areas. If these findings are representative of trends in use among relatively high income and comprehensively insured populations, the implications for the direction of national health care spending are serious. Between 1975 and 1980, Gibson and Waldo (1981, p.32) reported that nominal per capita expenditures on services of physicians increased from $113.38 to $201.18. Deflating by the physician services component of the Consumer Price Index[3] the estimated increase in constant 1967 dollars is from $66.93 to $73.91, or 10.4 percent, which is only one-fourth the increase for our largest market basket. If conditions in Michigan are representative of the effects of high incomes and insurance coverage, there are likely to be substantial increases in spending on physician services in the future as the economy grows. It is therefore clear that a better understanding of differences in patterns of use and how they are influenced by insurance, incomes and availability of resources, among other factors, is the critical element in formulating policies to deal with our health care spending crisis.

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[3] U.S. Department of Labor, Monthly Labor Bulletin, various issues.

4.4 Regressions

4.4.1 Specification of Utilization Equation

An estimation of the empirical equation (4) derived in Section 2.6, Chapter 2 is shown by regression (1) in Table 4-9. Demand-related variables are given by: real per capita income (Y); median school years for the adult population (ED); percent living in urbanized areas (URB); percent female (FEM); and percent less than five years old (LT5). The supply variables are: real fees per RVU, either charges (P_1) or payments (P_2); real manufacturing wages (W) as a proxy for factor costs; the physician-population ratio (MD/POP); and the bed-population ratio (BED/POP), to represent complementary resources. (Data sources are described in Appendix E.)

Because our data on fees and use cover only a segment of the entire physician-services market, we have included several variables to compensate for this gap. These are: the Blue Cross-Blue Shield penetration rate (BCBSM); the percent of the population over 65 (OV65) to represent a high-use population, almost all of which is covered by Medicare; and the percent of the population covered by Medicaid (MEDICAID).

In addition, we have experimented with and excluded some other variables, most notably a price variable, from the underlying demand equation. While excluding price may appear unusual, Michigan Blue Cross-Blue Shield has an extraordinary high participation rate. Ninety-four percent of all charges in our data for 1980 were on a pay-doctor basis. The out-of-pocket cost component on the pay-subscriber claims in 1980 represented only 1.3 percent of the total statewide charges. Not surprisingly, an out-of-pocket cost variable was insignificant in all estimates of use and fees and consequently was dropped from the regressions.

The nature of the data and this decision to omit a fee variable on the demand side have some important implications. First, it implies that the demand for covered services is perfectly inelastic with respect to fees. Second, the price coefficient in the reduced-form equation (4) in Chapter 2 contains only the supply parameter and the non-negative inducement coefficient. A negative value would suggest a backward-bending supply curve and possibilities of unstable equilibria. On the other hand, one should not be surprised with a positive price estimate when the supply curve is positively sloped and there is some inducement. Third, the minimal difference between payments per RVU and physician income per RVU (including the out-of-pocket cost component) raises questions about the most appropriate fee measure. The conventional practice is to adopt charges as the fee variable. However, payments are much closer to the effective transaction prices for our claims data. In addition, Blue Cross-Blue Shield increased its

Table 4-9

AGGREGATE

UTILIZATION AND FEE REGRESSIONS

Independent Variable / Dependent Variable	(1) QE	(2) QE	(3) QA	(4) QE(OB)	(5) QE(SU)	(6) P_1	(7) P_1
CONSTANT	25.575 (5.32)	29.195 (6.31)	38.749 (7.12)	5.736 (0.78)	32.686 (6.06)	3.467 (2.75)	2.307 (1.85)
P_1	1.302 (2.76)		0.871 (1.63)				
P_2		-0.800 (-2.25)					
LP_1							0.351 (2.96)
Y	0.284 (1.43)	0.441 (2.21)	1.185 (5.28)	1.032 (3.67)	0.623 (3.14)	0.083 (1.52)	0.041 (0.77)
ED	-6.727 (-4.41)	-7.016 (-5.03)	-11.13 (- 6.97)	-3.421 (-1.54)	-6.101 (-3.82)	-0.764 (-2.01)	-0.499 (-1.36)
URB	-0.286 (-2.86)	-0.265 (-2.60)	- 0.743 (- 6.58)	-0.432 (-2.62)	-0.162 (-1.52)	0.007 (0.25)	0.005 (0.19)
FEM	0.357 (0.29)	2.131 (1.83)	- 0.403 (- 0.29)		1.486 (1.14)	1.033 (3.30)	0.697 (2.21)
MINOR	0.037 (0.95)	-0.013 (-0.33)	0.243 (5.45)	0.170 (2.90)	-0.021 (-0.54)	-0.23 (-2.14)	-0.015 (-1.48)
LT5	0.148 (0.33)	-0.482 (-1.18)	-1.64 (-3.21)	-1.056 (-1.39)	-0.784 (-1.51)	-0.424 (-3.76)	-0.267 (-2.25)
OV65	-1.320 (-4.487)	-1.447 (-4.95)	-2.039 (-6.13)	-0.507 (-1.08)	-1.86 (-5.74)	-0.158 (-1.99)	-0.101 (-1.319)
BCBSM	0.139 (1.65)	0.323 (4.16)	0.083 (0.87)	0.091 (0.77)	0.275 (3.43)	0.095 (4.77)	0.065 (3.07)
MEDICAID	0.018 (0.16)	0.081 (0.74)	-0.533 (-4.29)	0.282 (-1.465)	0.309 (2.52)	0.048 (1.60)	0.032 (1.100)
MD/POP	0.283 (2.96)	0.209 (2.10)	0.301 (2.78)			-0.020 (-0.77)	-0.011 (-0.44)
BED/POP	0.123 (4.39)	0.099 (3.49)	0.061 (1.93)	-0.145 (-3.49)	0.155 (5.62)	-0.013 (-1.64)	-0.009 (-1.17)
W	-0.861 (-3.06)	-0.144 (-0.51)	-1.276 (-4.01)	-0.233 (-0.55)	-1.728 (-5.97)	0.315 (4.74)	0.214 (3.00)
D77	0.027 (0.70)	0.146 (4.20)	-0.059 (-1.30)	0.149 (2.11)	0.132 (3.89)	0.059 (7.33)	0.057 (7.58)
D78	0.047 (0.88)	0.234 (4.97)	-0.084 (-1.38)	0.299 (3.54)	0.181 (3.81)	0.089 (9.37)	0.066 (5.62)
D79	0.101 (2.02)	0.262 (6.39)	-0.031 (-0.55)	0.347 (4.26)	0.208 (4.41)	0.082 (9.01)	0.047 (3.18)
D80	0.084 (1.47)	0.279 (6.99)	0.023 (0.36)	0.443 (5.62)	0.184 (3.46)	0.104 (12.71)	0.077 (6.44)
P_1(OB)				-0.125 (-1.03)			
P_1(SU)					0.648 (1.72)		
OB/POP				0.006 (0.13)			
GS/POP					0.142 (2.27)		
PC/POP				-0.143 (-0.95)	0.013 (0.133)		
$\bar{R}^2$	0.938	0.935	0.945	0.720	0.931	0.913	0.923

NOTE: QE represents quantity per 1,000 effective Blue Cross-Blue Shield population; QA, quantity per 1,000 actual population; P_1, real charges per RVU; and P_2, real payments per RVU. QE(OB) in regression (4) is quantity per 1,000 effective female population over 18 and less than 45 years of age. All variables, except for the time dummies are measured in logarithms and N = 75 in each regression. The Durbin-Watson statistic in regression (7) is 1.99.

maximum screens only three times[4] after 1975, in 1977, 1978 and 1980. Thus, one may argue that payments are a reasonable proxy for fees and that there also were significant price rigidities in the period under study. Estimates of the use equation with either charges or payments were generally similar, although, as discussed below, the former measure is empirically superior.[5]

In addition, we have unsuccessfully experimented with proxies to control for health status and differences in product quality and amenity attributes. For the former, we tried various mortality indices, an index of infectious and communicable diseases, and a measure of work-loss and restricted-activity days compiled from workmen's compensation data. None of these measures were significant in any regressions and are not shown in the results presented here.

As for product differences, we introduced several proxies taken from a survey conducted in 1981 of Michigan physicians. The variables, averaged for each market area, were: length of visit, in-office waiting time, wait-to-appointment for established patients, years of experience, and percent board certified. Because the regression estimates had an unusual number of "wrong" signs, and because the survey is of limited usefulness in aggregated analysis,[6] these results are not reported here.

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[4] This figure excluded certain selective and technical adjustments for some benefit categories.

[5] We have experimented also with total physician income per RVU including the estimated out-of-pocket cost component. Because the results are virtually identical to payments regressions, and because a survey that we have conducted indicates substantial uncollectibles for these patient payments, we decided not to pursue this approach.

[6] With only 15 market areas observations, we used the same respective values for each year of the pooled cross-sections. In addition, quality/amenity characteristics should properly be treated as endogenous variables, which was impossible for lack of observations.

Finally, we attempted to include several other possible indicators of product or practice differences, such as percentage of specialists or percentage of doctors of osteopathy (D.O.), which might influence either demand or supply.[7] None of these variables were significant in any utilization or fee regression and were dropped from the models.

4.4.2 Estimates

Ordinary least-square (OLS) estimates with use per effective population (QE) as the dependent variable and charges (P_1) and payments (P_2), respectively, as alternative fee variables are shown by regressions (1) and (2) in Table 4-9. With 1975 data needed for lagged variables, there are 75 observations covering 1976-1980. Time dummy variables are included for 1977-1980 to capture the effects of structural changes over this period. It is important to recall that the use equation is in double-log form so that the coefficients represent elasticities and that the coefficient of MD/POP produces an estimate of the demand-shift factor.

While some interesting differences between the two regressions can be seen, the coefficient of MD/POP is positive and significant in both at the 1 percent level. Estimates of the inducement effect are 0.28 percent and 0.21 percent, respectively, for a one percent increase in the physician-population ratio. While some other regressions, including those on sub-baskets of the 424 procedures, suggest that the former appears to be high and that the latter is likely to be the more reliable value, the estimates clearly support the demand shift hypothesis. A strong positive elasticity of approximately 0.1 is evident also for the availability of hospital beds.

The two regressions conform as well on the negative effects of education, urbanization, and percent over 65. Similarly, while signs are consistent for income and the Blue Cross-Blue Shield penetration rate, they are significant only at the five percent level in regression (2).

As for some differences, the percentage of females is significantly positive in regression (2), as one would predict, but not in (1). Wages are negative and highly significant in (1), again as expected, but not in (2). However, there is a more important difference. In regression (1) the coefficient of real charges per RVU is positive and

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[7] D.O.'s are common Michigan, representing 19 percent of all physicians.

significant, compared to a negative and significant coefficient for real payments per RVU in (2). Although we might argue that our estimates are representative of the physician service market as a whole and that with a negatively sloped demand curve, a negative coefficient of price would not be surprising (recalling from equation (4) in Chapter 2, Section 2.6 that it combines demand, supply and inducement effects), we cannot ignore the limitations of our data. Our indices of fees and use were derived for a specific population and a set of procedures for which there is virtually complete insurance coverage and where we have already assumed a perfectly inelastic demand curve with respect to fees. A negative fee coefficient as in regression (2), therefore, suggests a backward-bending supply curve. While this behavior is plausible and has been suggested elsewhere in the literature (e.g., Feldstein, 1970), it would imply unstable competitive equilibria and negate our long run fee hypothesis. Nevertheless, in light of regression (1) and the estimates of the fee model, which are provided below, we feel that the backward bending supply hypothesis is not strongly supported here. However, the results suggest that the possibility of a negatively sloped supply case should not be overlooked in further work of this type.

Regression (3) in Table 4-9 uses quantity per actual population (QA) rather than the adjusted measure as the dependent variable. Compared to regression (1), income, percent, minority, 'percent less than five years of age, and percent of Medicaid are now each highly significant while charges are not quite significant, though positive, at the five percent level. As for the inducement coefficient, it is slightly higher in (3)--a relationship that held for every comparable regression where QA is substituted for QE as the dependent variable.[8] In many of our experiments, the inducement factor was as much as twice as high when actual quantity replaced effective quantity. We therefore conclude that an accurate determination of market areas and corrections for bordercrossing are important and reduce estimates of the inducement phenomenon as has been suggested in the literature.

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[8] It is 0.25 vs. 0.21 in the analogue to regression (2).

4.4.3 Sub-baskets

Regressions (4) and (5) are estimates of the model for a maternity sub-basket (with 13 procedures related mainly to delivery) and a surgical sub-basket (with 340 procedures), respectively. The physician availability variables in regression (4) are the obstetrics-population ratio (OB/POP) and the primary care (GPs, FPs, and internal medicine) population ratio (PC/POP). Because the dependent variable is use per effective female population (over 18 and less than 45), percent female is omitted. For surgery the availability variables are the general surgeon-population ratio (GS/POP) and PC/POP.

Neither physician availability variable was significant in the OB regression for utilization. In regression (5), GS/POP is significant with a coefficient of 0.14 (0.20 in the corresponding payments regression, not shown).[9] The primary care-population rate is not significant, and BED/POP is positive and highly significant with an elasticity of 0.15.

These findings are consistent with the inducement hypotheses. Especially where care is more discretionary, e.g. elective surgery, physicians may be expected to have greater influence over their patients decisions, which manifests itself in the form of a demand shift. Our results show also how the availability of complementary resources such as hospital beds facilitates this process.

4.4.4 Fee Regressions

In the long run, fees are assumed to adjust with a lag toward the market clearing level, as given in equation (5) in Chapter 2, Section 2.6. The fee regression, as seen from equation (6) in Section 2.6 contains the same demand and supply variables as the utilization equation, except that now the complement of the coefficient of the lagged price ($\hat{\beta}_4$) provides an estimate of the speed of adjustment.

Although we have used the same data as before for the fee regressions, it is important to remember that the former is a short run cross-sectional model. Cross-sections were pooled to increase the number of observations. The long run model, on the other hand, is a dynamic time-series model. It cannot be estimated from cross-sectional data alone.

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[9] Our findings are reasonably consistent with those of Fuchs (1978).

Before we discuss estimates of this model, regression (6) in Table 4-9 represents a reduced form estimate of an equilibrium model of the type commonly found in the literature. In this Reinhardt-type fee test, a significant positive MD/POP coefficient is interpreted to support inducement and/or target-income forms of pricing.

There are no unusual coefficients in regression (6) to suggest the possibility of major specification errors. In fact, the good overall fit might be interpreted to indicate that the speed of adjustment in estimates of equation (6) could be relatively rapid. Positive effects on real charges are associated with percent female, wages, and the Blue Cross-Blue Shield of Michigan penetration rates. There is also a strong positive time trend. Negative effects are associated with education, percent minority, percent less than 5, and percent over 65. The most important finding, though, is the absence of any positive impact on charges of physician density. Such a positive effect would be inconsistent with our own price adjustment hypotheses in which fees move toward the competitive levels. In fact, the payments equivalent to regression (6), not shown, has a negative MD/POP coefficient (-0.06) with a t-ratio of 1.69, which is significant at the five percent level in a one-tail test.

Although the equilibrium model appears to work reasonably well, our theory of inducement rests on the assumption of a disequilibrium process resulting from price rigidities and the hypotheses that prices do not fully adjust annually. Regression (7) tests this hypothesis where charges represent fees. (We recognize that MD/POP in the long run should be treated as an endogenous variable and simultaneous-equations methods considered. Experiments with a physician-location equation for the long run model produced high R^2s for that equation, but also many wrong signs for its coefficients. Consequently we judged that the corresponding 2SLS estimates of the fee equation were not reliable.) From the coefficient of the lagged fee variable, which is highly significant, the speed of adjustment is 0.65, i.e., that about two-thirds of the adjustment process is completed within a year. In the equivalent-payments regression, not shown, the speed of adjustment is lower at 0.48, which is not surprising given the reimbursement mechanism during the period under study. Most other coefficients in (7) are similar to those of the equilibrium fee model. In particular the coefficient of MD/POP is negative, but insignificant in both regressions (6) and (7), although it is negative and significant in the payments version of (7), not shown in Table 4-9.

We conclude that our fee hypothesis is supported by the data. Fees do not adjust fully within a year. Approximately half to two-thirds of the gap between the current and equilibrium fees is closed annually. Greater physician concentrations do not result in higher equilibrium fees. There is some inconclusive evidence that the effect is negative.

4.5 Conclusion

This Chapter developed a testable theory of inducement under the hypothesis that short run fee rigidities prevent physicians from operating on their ex ante supply curves. With an ex ante excess supply or excess demand, physicians have an incentive to manipulate demand. Whether they react to this incentive and by how much, is however an empirical issue. Tests of the model using extensive and extremely accurate market area data on fees and use, which have been further adjusted to prevent many of the serious measurement errors found elsewhere, support the demand-shift arguments. Despite some instability in the estimates of the inducement factor, the overall evidence suggests that a one-percent increase in physician density will, ceteris paribus, increase per capita use by approximately 0.2 percent. Estimates of the model on sub-baskets of procedure are consistent with this value and indicate that inducement is only a phenomenon for care likely to be discretionary, as with surgical and diagnostic services.

In the long run, the fee regressions indicate that prices move toward competitive levels, contradicting the target-income hypothesis. Estimates of the speed of the adjustment coefficient indicate a relatively rapid movement toward equilibrium, with at least one-half the gap between the existing and equilibrium fee levels closed annually.

The following two chapters examine these hypotheses using individual physician fee and intensity of care utilization indices for the Blue Shield and Medicare populations, respectively. The major difference in the hypotheses, as explained in Chapter 2, is that inducement is expected to appear through a greater intensity with which care is provided per unique patient.

Chapter 5

Microeconomic Analysis -- Blue Shield Data

5.1 Physician Sample Frame

Using the claims data for the "Grand Total" of 424 procedures previously described in Chapter 4, charge and utilization indices were created for every physician between 1975 and 1980. The major indices developed for each year include: the number of distinct patients serviced; the total RVUs provided; total nominal and real charges; total nominal and real payments; and similar charge and payment data distinguished on a pay-doctor pay-subscriber basis.

A compiled tape was then created. This tape merges all the secondary data that were collected and developed on a market-area basis with the indices of individual physicians. There are approximately 12,000 observations for each of the six years of the study on the compiled tape. A cohort sample was then selected of all physicians who have remained in the same market over the 1975-1980 period and provided at least 10 RVUs per year, producing 7200 physicians in our sample.

The microeconomic analysis focused on three specialty groupings: primary care (PC), consisting of general practice, family practice, internal medicine, and pediatrics; general surgery (GS); and obstetrics-gynecology (OBGYN). With relatively large numbers (N) in these groups, the data was further edited for greater reliability. Most significantly, because of provider coding differences before 1976, multiple record tags, and thus multiple observations, for many physicians appeared in the 1975 data. Since BCBSM no longer had the information necessary to merge all the respective observations for every provider in 1975, that year was dropped from the analysis.

Some additional editing, which reduced the sample sizes on the order of two to three percent depending on the grouping, were intended to improve further the quality of the data. Physicians must have provided at least fifty RVUs and seen at least ten distinct patients per year. Observations with unusually low fees were also eliminated, as were fee outliers in the regression analyses.[1]

Two other physician groupings were examined also: other surgical specialties (neurological, opthalmalogical, orthopedic, otolaryngology, plastic, colon and rectal, thoracic, and urology); and other specialties (anesthesiology, pathology, radiology, and neurology). Because some of the subspecialties have very few observations, the fifty RVU-ten patient criteria used above were dropped here.

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[1] As a result, the respective samples do not contain exactly the same number of observations in each year. With many experiments performed in editing the data, the computer time costs in continually re-sorting in order to get a completely pure cohort sample, in which every physician is represented in each of the years, would have been prohibitive.

5.2 Descriptive Findings

The market area and statewide mean data for these groupings are shown in Tables 5-1 through 5-6. To compare more closely with the aggregated indices in Chapter 4, the weighted averages for nominal charges per RVU (NC), real charges per RVU (RC), and RVUs per patient (Q) for 1980 are shown. In addition, the respective percent changes between 1976 and 1980, the coefficients of variation for charges per RVU (the real and nominal value is the same for each market area), and Q for 1980 are included. These indices provide evidence of intramarket variations in fees and use--evidence that was unavailable from the aggregated data.

5.2.1 Primary Care

Fee and use data for 1980 and percent changes between 1976 and 1980 for 2,964 primary care providers are shown in Table 5-1. Although most of the aggregated work was performed on market baskets of procedures, the limited aggregated analysis by specialty groupings is generally consistent with the findings presented here. The nominal charge per RVU was previously shown as $14.62 for primary care providers in 1980 (Chapter 4, Table 4-5). The mean charge here is $14.37. As before, the major metropolitan areas have the highest nominal charges (Grand Rapids is an exception in both cases), and the smaller, more rural markets show the lowest charges. One striking exception is St. Joseph with a nominal charge of $15.02, as compared previously to a nominal charge of $11.52. However, with only 29 observations, the data in this sample may not be representative of the market.[2] Across market areas, real charges per RVU are highly uniform, even though the large urban areas continue to lead the way. Excluding St. Joseph, the high RC of $9.44 in Detroit exceeds the low value of $8.13 for Grand Rapids by 16 percent.

The aggregated data were useful in providing accurate measures of interarea fees. With these individual-physician data, the intraarea patterns can now be examined. The smallest markets tend to have the largest dispersion in fees, as measured by the coefficient of variation (CV). The remaining markets including the largest, show highly uniform CVs, typically in the 17-21 range.

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[2] There are a number of extreme values in Tables 5-1 through 5-6 that are found disproportionately among smaller markets where a few or even one outlier, if it has a relatively heavy weight, may substantially affect that market's average. In the particular case of St. Joseph, there were no unusually high charges per RVU among any of its 29 primary care providers.

Table 5-1

FEES AND USE FOR PRIMARY CARE PROVIDERS: 1980; PERCENT CHANGES 1976 - 1980; AND COEFFICIENTS OF VARIATION: 1980

Market Area					% Change: 1976-1980			Coefficient of Variation	
(Major City)	N	NC	RC	Q	NC	RC	Q	NC(RC)	Q
Bay City	57	13.20	8.82	6.91	58.5	14.5	5.3	46.0	48.4
Petoskey	47	13.24	8.77	8.53	54.5	15.1	22.4	19.1	75.5
Flint	218	14.16	9.27	8.05	52.1	13.6	9.5	19.5	68.2
Traverse City	76	12.38	8.33	8.30	48.3	12.1	3.5	17.5	85.5
Lansing	133	13.04	8.37	11.00	50.5	13.3	35.8	18.8	107.0
Kalamazoo	149	12.72	8.41	9.50	40.2	1.8	-1.1	21.1	63.8
Grand Rapids	235	12.04	8.13	10.49	46.7	8.4	7.0	17.1	80.3
Warren	218	15.05	9.41	8.78	47.3	5.6	7.1	17.5	80.8
Marquette	55	12.20	8.83	7.07	45.9	7.7	-6.6	24.3	33.9
Muskegon	71	12.32	8.64	7.15	47.2	7.9	-10.3	15.6	53.5
Pontiac	439	14.62	9.14	8.20	46.2	4.9	7.5	17.2	78.3
Saginaw	159	12.96	8.52	7.44	54.3	10.6	-10.7	15.5	42.6
Ann Arbor	179	13.89	8.73	8.14	44.5	4.6	6.7	21.7	66.6
Detroit	899	15.10	9.44	9.65	47.0	5.5	-3.1	21.2	82.0
St. Joseph	29	15.02	9.95	9.73	105.7	52.4	-7.0	36.3	57.6
Weighted Mean	2964	14.37	9.14	8.88	48.5	6.5	2.7	20.7	79.8
Unweighted Mean	2964	13.64	8.74	6.94	45.4	6.0	-2.3	23.5	74.1

NOTE: The market area values are weighted (by RVUs) averages. The primary care specialties include: general practice, family practice, internal medicine, and pediatrics. The coefficients of variation for nominal and real charges per RVU are identical for their respective market areas -- the values for real charges are given for the state means.

As for the growth in charges between 1976 and 1980, the nominal increase for the state was 48.5 percent, and the real increase was 6.5 percent. Although, aggregated growth rates for provider groups were not previously studied, these data are consistent with the general trends in growth shown in Chapter 4.

Turning to the intensity with which care is provided, there are no common measures that can be compared across both the aggregated and micro data sets. The aggregated data, however, did indicate very large growth rates in output per eligible beneficiary, with the large metropolitan areas having both the highest per capita use rates and the largest increases in these rates. In terms of RVUs per unique patient, the Detroit-Flint markets hover above the weighted state mean of 8.88 in 1980. Lansing and Grand Rapids are distinctly higher than the remaining markets, while some, though not all, the smaller markets such as Bay City, Marquette and Muskegon, have distinctly lower rates. The overall market differences, however, are not nearly as dramatic as suggested by the aggregated use rates based on effective population.

While the growth rates in three of the four Detroit-Flint corridor markets were above the overall mean, Detroit had a decrease in Q. Six markets in all showed decreases, while only two, Petoskey and Lansing, showed sharp increases.

The contrast between the high aggregate growth rates per capita and the modest overall increase in the intensity with which care is provided to patients suggests that either: (i) a higher proportion of eligible recipients are receiving care; or, (ii) patients are visiting a large number of different physicians. These possibilities are especially likely in the major metro-areas, which have had a high level and growth in use per eligible user, but which tend to show average intensity and growth in Q.

5.2.2 General Surgeons

The corresponding data for general surgeons are shown in Table 5-2. The weighted mean nominal charge of $16.06 is only slightly higher than the aggregated $15.94 charge for all surgeons shown in Chapter 4, Table 4-5 but distinctly higher than the aggregated $15.15 charge previously found for the 340-procedure surgical market basket. (Chapter 4, Table 4-2).

General surgeons' fees increased at a slightly lower rate than the growth in primary care providers' fees. Significantly, the Detroit-Pontiac-Warren markets, had relatively low growth rates.

Table 5-2

FEES AND USE FOR GENERAL SURGEONS: 1980; PERCENT CHANGES 1976 - 1980; AND COEFFICIENTS OF VARIATION: 1980

Market Area (Major City)	N	NC	RC	Q	% Change: 1976-1980 NC	RC	Q	Coefficient of Variation NC(RC)	Q
Bay City	21	14.53	9.70	17.67	53.6	11.0	-7.7	12.6	28.2
Petoskey	10	13.37	8.86	12.07	76.6	31.5	-33.9	16.3	39.1
Flint	57	16.61	10.88	17.42	52.7	8.3	17.9	21.4	37.7
Traverse City	21	12.60	8.48	14.40	39.4	5.6	-2.4	13.3	35.3
Lansing	74	14.95	9.59	20.96	45.7	2.5	8.0	21.8	35.6
Kalamazoo	42	14.14	9.35	16.03	53.9	11.7	-18.8	20.0	31.3
Grand Rapids	78	14.26	9.63	17.14	49.9	10.8	-1.7	19.5	34.2
Warren	59	16.86	10.54	14.46	35.1	-0.9	11.7	20.8	46.1
Marquette	17	13.31	9.63	12.13	36.8	0.9	-4.2	17.9	49.5
Muskegon	11	15.29	10.72	19.65	64.6	20.6	9.8	6.7	31.4
Pontiac	103	16.97	10.61	15.79	43.3	2.8	7.9	24.8	41.4
Saginaw	28	13.59	8.94	15.92	47.4	4.6	-8.8	13.8	35.8
Ann Arbor	54	14.79	9.29	18.03	43.2	3.5	-1.6	14.1	33.5
Detroit	258	16.76	10.48	16.31	42.8	2.3	1.1	19.4	54.4
St. Joseph	15	13.26	8.79	16.75	31.4	2.5	11.7	18.5	34.0
Weighted Mean	798	16.06	10.22	16.46	45.1	4.3	2.5	21.1	50.3
Unweighted Mean	798	15.43	9.89	14.53	43.3	3.3	0.5	23.7	47.9

NOTE: The market area values are weighted (by RVU's) averages. The coefficients of variation for nominal and real charges per RVU are identical for their respective market areas -- the values for real charges are given for the state means.

The interarea pattern is very similar to the one shown previously in Table 4-5 for surgical specialists. Detroit, Flint, Pontiac, and Warren are the only markets that have average fees over $16 per RVU in both samples, while, Grand Rapids, Marquette, and St. Joseph show charges of less than $14 in both cases. Only Petoskey and Traverse City have markedly different fees than those shown in Chapter 4.[3]

The two main features of the data in Table 5-2 are: first, the relative uniformity of both fees and use rates as compared to those of primary care providers. The CVs for fees of both groups are virtually identical, while the GSs have a substantially lower CV for the use rate. Leaving out Petoskey, whose growth in fees and use appear suspect, and Marquette, with Q's in the 12 range, the remaining markets fall in the 14.4 to 21 range. In addition, all of the big markets are close to the weighted state mean. The CVs across markets are, furthermore, extremely uniform as compared to primary care providers.

The second important result is that the growth in Q was only 2.5 percent since 1976 -- an unexpected result after seeing the large overall per capita growth in use of surgical services. Subsequent data on other surgeons will indicate large increases in RVUs per patient for some sub-specialties with the possibility that the aggregated data were heavily affected by those components.

5.2.3 Obstetricians-Gynecologists

The indices for OBGYNs are shown in Table 5-3. Five markets have seven or less observations. The data for these five cases, however, do not appear to be outliers when compared with other markets, except for Traverse City and Muskegon, where anomalies in comparison with their respective general surgeons' fees exists. In the case of Traverse City and Muskegon, the GS charges are more unusual than those shown here.

The state mean NC of $15.84 is close to the general surgeons' charge of $16.06 (Table 5-2) and the other surgical specialists' charges of $15.74 (Table 5-4), but is substantially above the aggregated $14.25 charge for the obstetrics bundle of services found in Chapter 4 (Table 4-4). The latter figure might be attributed to the large volume of OBGYN care that might be provided by primary care physicians whose mean NC is $14.37.

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3 Other surgeons in these latter two markets have somewhat higher fees raising the means for all surgeons. The caveat about markets with a small number of observations should also be considered.

Table 5-3

FEES AND USE FOR OBSTETRICIANS - GYNECOLOGISTS: 1980
PERCENT CHANGES : 1976 - 1980; AND
COEFFICIENTS OF VARIATION: 1980

Market Area (Major City)	N	NC	RC	Q	% Change: 1976-1980 NC	RC	Q	Coefficient of Variation NC(RC)	Q
Bay City	6	14.35	9.58	21.61	51.1	9.1	1.7	4.9	14.0
Petoskey	7	13.67	9.06	17.77	50.2	11.7	10.6	12.3	20.7
Flint	25	14.55	9.53	16.47	63.3	15.9	-15.6	19.3	39.6
Traverse City	7	15.45	10.39	21.64	44.5	9.3	-2.0	5.1	25.4
Lansing	22	15.74	10.10	22.66	39.7	-1.8	6.1	7.5	10.8
Kalamazoo	28	14.71	9.73	19.39	47.5	7.3	-3.3	12.1	16.5
Grand Rapids	58	13.30	8.97	19.93	40.3	3.5	-2.0	10.0	20.2
Warren	56	15.49	9.94	16.01	31.9	-2.8	4.7	12.4	30.8
Marquette	7	14.21	10.28	17.00	32.2	-2.5	-17.0	7.3	26.9
Muskegon	7	13.66	9.58	21.54	37.0	0.4	0.3	14.5	21.0
Pontiac	114	16.27	10.17	14.26	34.6	-3.4	-3.0	15.0	43.0
Saginaw	26	14.16	9.31	17.84	40.5	7.6	-27.9	9.8	24.5
Ann Arbor	48	14.09	8.86	21.39	38.8	0.5	-1.7	11.8	20.3
Detroit	202	16.91	10.57	16.76	39.2	-0.2	-6.0	19.0	30.5
St. Joseph	10	13.41	8.89	23.48	40.0	3.7	9.3	11.5	15.2
Weighted Mean	623	15.84	10.03	17.12	39.6	0.2	-4.7	16.8	33.2
Unweighted Mean	623	15.48	9.87	16.58	38.2	-0.3	-4.2	18.4	38.1

NOTE: The market area values are weighted (by RVU's) averages. The coefficients of variation for nominal and real charges per RVU are identical for their respective market areas -- the values for real charges are given for the state means.

The overall patterns are similar to those discussed above for both primary care and general surgery. There was essentially no growth in real charges between 1976 and 1980 and the RVUs per patient fell almost five percent. Given the high growth in per capita use of obstretics services, this also is an unexpected result. OBGYN fees are also the most uniform of the three groupings.

5.1.4 Other Surgical Specialties

Fee and use data for other surgical specialists are shown in Table 5-4. Some markets have relatively few observations so that aberrations and outliers may be more likely. The weighted state mean for nominal charges of $15.74, however, is reasonably close to the aggregated state mean of $15.94 (Table 4-5) for surgical specialists, which included all surgeons. Furthermore, the charge patterns across market areas are very similar, even for St. Joseph. As before, Detroit has the highest nominal charge and Grand Rapids the lowest. The same markets have the respective high-low real charges also. The overall growth in fees, however, is substantially higher than those of any other group in the study. In particular, as the dominant market, Detroit had a growth in real fees well above the state means.

The most striking feature in Table 5-4 is the marked disparities in RVUs per patient. These range from 13 to 15 RVUs per patient in Traverse City, Warren and St. Joseph to over 51 in Grand Rapids, which is adjacent to St. Joseph and which may serve many of the more serious cases in that area. Similarly, Detroit, Pontiac and Ann Arbor may provide care for the more serious cases from Warren, which does not have any large research-and university-affiliate hospitals.[4]

The smaller areas, aside from Petoskey, tend to have lower RVUs per patient --while the major areas tend to have higher rates. Ann Arbor, with its prestigious hospitals, is another exception. Interestingly, also, Detroit is slightly below the weighted state mean.

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[4] These findings strongly suggest that differences in the mix of services provided across markets is another interesting topic that could be investigated with this data base.

Table 5-4

FEES AND USE FOR OTHER
SURGICAL SPECIALISTS: 1980
AND PERCENT CHANGES: 1976 - 1980

Market Area (Major City)	N	NC	RC	Q	% Charge: 1976-1980 NC	RC	Q
Bay City	12	15.48	10.33	24.94	87.0	35.0	65.0
Petoskey	11	14.04	9.30	43.43	52.1	13.0	9.1
Flint	45	16.15	10.58	30.57	53.1	8.5	12.9
Traverse City	16	14.14	9.52	13.70	60.3	21.3	-13.0
Lansing	42	14.96	9.60	34.67	55.7	9.6	43.6
Kalamazoo	52	14.10	9.33	22.23	50.0	9.1	-19.6
Grand Rapids	88	12.91	8.71	51.54	41.7	4.6	45.0
Warren	44	16.28	10.18	15.08	43.7	3.0	-1.3
Marquette	17	13.23	9.57	28.07	44.1	6.3	69.0
Muskegon	20	13.16	9.22	18.88	80.3	32.1	7.5
Pontiac	151	15.61	9.76	31.27	42.8	2.4	31.0
Saginaw	35	13.35	8.78	19.07	59.7	14.5	-2.8
Ann Arbor	64	14.55	9.14	46.80	48.8	7.5	-9.2
Detroit	263	17.11	10.70	28.53	63.6	17.3	19.6
St. Joseph	10	13.77	9.13	15.71	49.5	10.9	-19.8
Weighted Mean	875	15.74	10.00	30.70	53.6	10.4	18.1
Unweighted Mean	875	14.85	9.52	19.39	47.5	6.5	7.7

NOTE: The values are weighted (by RVUs) averages. Other surgical specialties include: Neurological surgery; opthamological surgery; orthopedic surgery; otolarynyology; plastic surgery; colon and rectal surgery; thoracic surgery; and urology.

Unlike the other specialty groups mentioned above, the intensity with which these surgical specialists have treated their patient has been growing rapidly. The weighted growth between 1976 and 1980 was 18.1 percent. This growth, however, has been highly uneven across markets. Two small markets, Bay City and Marquette, had extraordinary growth of 65 and 69 percent, respectively, while Lansing and Grand Rapids were in the 40 percent range. With the exception of Warren, the Detroit-Flint group experienced increases ranging from 13 to 31 percent. Some markets, such as Traverse City, Kalamazoo and St. Joseph, had sharp decreases.

Because of differences in specialty mix, the CVs are not shown in Table 5-4. Instead, subspecialty data are given for the three largest markets, as measured by the number of specialists, in Table 5-6. The data for cells with less than five observations are omitted to protect the confidentiality of the providers.

Table 5-6 shows that, while there may be large differences in fees across markets, Grand Rapids is generally among those with the lowest fees. While both Detroit and Pontiac usually have among the highest fees, intramarket differences across the specialties are quite small. The number of RVUs provided per patient, though, spans a large range, with thoracic surgery highest and urology lowest. There are disparate increases in Q across markets, also, but thoracic surgery is consistently high, while urology and orthopedic surgery have had negative or zero growth since 1976.

5.2.5 Other Specialists

The last specialty grouping consists of anesthesiologists, pathologists, radiologists, and neurologists. Their indices are found in Table 5-5, with subspecialty breakdowns[5] for the three largest markets shown in Table 5-6.

The weighted state mean charge of $12.74 in Table 5-5 is relatively low. There are substantial differences in specialty mix which make intramarket comparisons difficult, since the relative distribution within markets among the specialties considered varies substantially. Notwithstanding this caveat, the data in Table 5-5 indicate that Detroit and Bay City have substantially higher fees than other markets while Flint, Pontiac, Warren and Ann Arbor are the only other markets with charges over $12 per RVU. Four markets have a NC less than $10. The state increase in fees was considerably lower than for the other surgical specialists and more in line with the increases for the other groups under study.

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[5] There are not enough observations for pathologists to be able to report individual market-area data.

Table 5-5

FEES AND USE FOR OTHER SPECIALTIES: 1980; AND PERCENT CHANGES: 1976 - 1980

Market Area (Major City)	N	NC	RC	Q	% Change: 1976-1980 NC	RC	Q
Bay City	11	14.24	9.51	11.32	45.3	2.8	-24.6
Petoskey	6	11.94	7.91	7.24	50.2	11.7	106.9
Flint	30	12.77	8.36	9.99	55.2	10.0	-2.6
Traverse City	7	9.24	6.22	14.12	-25.1	-43.4	308.1
Lansing	17	9.28	5.95	9.54	41.0	-0.8	27.2
Kalamazoo	16	11.62	7.69	8.72	47.5	7.3	1.5
Grand Rapids	56	11.71	7.91	10.17	63.8	20.9	1.7
Warren	23	12.46	7.79	10.20	37.5	-1.4	0.0
Marquette	6	10.58	7.65	2.77	6.8	-21.2	-37.5
Muskegon	19	9.70	6.99	9.75	67.8	26.4	0.0
Pontiac	61	12.05	7.53	11.74	30.8	-6.2	7.3
Saginaw	17	10.84	7.13	12.17	48.7	6.6	29.1
Ann Arbor	21	13.19	8.29	8.76	52.7	10.4	27.0
Detroit	92	14.42	9.01	9.30	41.0	4.3	27.9
St. Joseph	3	*	*	*	*	*	*
Weighted Mean	385	12.74	8.14	10.14	43.1	3.0	11.4
Unweighted Mean	385	12.07	7.78	11.49	50.1	8.4	4.0

NOTE: The values are weighted (by RVUs) averages. Other specialties include: anesthesiology; pathology; radiology; and neurology. The * indicates less than 5 observations for which data are excluded to protect the confidentiality of the providers.

Table 5-6

FEES AND USE FOR SELECTED SPECIALTIES IN THREE MARKET AREAS: 1980; AND PERCENT CHANGES: 1976-1980

	GRAND RAPIDS				PONTIAC				DETROIT			
Other Surgical Specialties	N	NC	RC	Q	N	NC	RC	Q	N	NC	RC	Q
Neurological Surgery	3	*	*	*	8	15.68 (47.6)	9.80 (5.8)	29.52 (-2.0)	25	16.51 (13.2)	10.10 (13.2)	23.69 (17.7)
Opthamology	17	12.73 (42.1)	8.59 (-4.7)	20.19 (-0.9)	46	14.48 (46.3)	9.05 (4.9)	17.04 (15.1)	66	16.19 (50.9)	10.13 (8.3)	19.20 (9.1)
Orthopedic Surgery	29	12.58 (42.1)	8.49 (-4.1)	17.91 (-6.1)	38	15.00 (44.0)	9.38 (3.3)	10.85 (0.0)	59	15.31 (48.5)	9.57 (6.5)	12.03 (-1.6)
Thoracic Surgery	5	11.93 (35.0)	8.05 (-8.9)	117.43 (29.6)	10	14.62 (43.5)	9.14 (2.9)	32.76 (31.9)	25	15.76 (47.6)	9.85 (5.8)	37.94 (15.8)
Urology	14	12.61 (69.7)	8.51(-14.5)	11.60 (-6.2)	19	14.82 (45.4)	9.26 (4.3)	8.83(-24.7)	45	16.21 (54.4)	10.13 (10.7)	12.03 (-2.7)
Other Specialties												
Anesthesiology	26	7.93 (53.7)	5.35 (3.7)	20.15 (0.5)	33	9.30 (53.5)	5.81 (9.8)	18.09(-10.8)	30	9.22 (37.4)	5.77 (-1.2)	18.09 (6.0)
Neurology	2	*	*	*	8	14.33 (51.3)	8.96 (8.5)	6.82(-18.7)	22	16.41 (73.3)	10.26 (24.4)	10.38(-13.2)
Radiology	24	15.12 (89.2)	10.21 (27.8)	2.31 (-2.5)	11	16.49 (35.6)	10.31 (-2.6)	2.52 (15.6)	28	17.57 (49.3)	10.98 (7.0)	2.98 (10.8)

NOTE: The values are weighted (by RVUs) averages; the percent charges are given in parenthesis; and the asterisk indicate less than 5 observations for which data are excluded to protect the confidentiality of the providers.

The RVUs per patient, except for Marquette, fall into a surprising narrow range, given some small sample sizes and the heterogeneity among providers. The unusual percentage changes in fees and/or intensity for Bay City, Petoskey, Traverse City and Marquette must reflect these factors.

Overall growth in Q since 1976 was 11.4 percent, but, as shown in Table 5-6, there are sharp differences among the specialists. For example, Q decreased for neurologists in the state's two largest markets, but sharply increased there for radiologists. The pattern among anesthesiologists is mixed.

5.2.6 Summary

The descriptive findings indicate:

1. With respect to fees, we found market-area patterns that are similar to those described in Chapter 4 for the aggregated data. The statewide growth in nominal fees appear to have increased substantially, but real fees, except for other surgical specialists, have grown only slightly.

2. The intensity with which patients are treated in any of the specialty groupings is not generally greater in the major markets that have shown high per capita rates and growth in use. Furthermore, there is no obvious consistent pattern in the intensity variable.

3. Since 1976, there has been only slight growth in the intensity measure among primary care providers and general surgeons and a decrease for OBGYNs. There were more substantial increases among the other specialty groupings (18 percent for other surgical specialties and 11 percent for other specialties), but even these appear to be concentrated among particular subspecialties such as thoracic surgery.

4. The micro sample provides evidence on intramarket variations in fees and use that was unavailable in the aggregated data. The major metropolitan areas do not stand out in the dispersion of their fees or use rates. Across the three specialty groupings for which CVs are provided, the dispersion in fees is comparable. With respect to the intensity of care, OBGYN has the lowest average CV, with primary care the highest--substantially greater than for general surgery.

5.3 Econometric Results

Before econometric models similar to those developed in Chapter 4 were estimated, some changes were required due to the different analytic unit. First, as mentioned previously, the use variable is measured as RVUs provided per unique patient and not actual or effective use per eligible beneficiary. The corresponding adjustment for bordercrossing effects is thus provided by using physicians-to-effective population ratios. These ratios were developed by multiplying the actual ratio in every market by that market's ratio of actual to effective Blue Shield population. If this latter ratio is one, there is no net bordercrossing, and the effective physician-population rate is the same as the actual rate. A ratio greater than one indicates that physicians serve a smaller population than the membership indicates, and that the effective physician-population rate is greater than the actual rate. For example, Oakland, which is a major exporter of care would show a smaller effective than actual physician-population ratio. These measures should provide more accurate indicators of physician availability. Although the hospital market may deviate substantially from physician-service markets, the two may be correlated, and we have used this adjustment also to develop a bed-effective population measure.

Second, we have eliminated fee outliers (the 1 percent tail ends), believing that many may reflect "adjustments" in billings. Interestingly, the regression estimates were highly stable with respect to more extensive editing (e.g., including only the 5-95 percent intervals and/or editing the use variable, which has a wide range of values).

There were slight changes also in the explanatory variables. For example, some health status measures were significant in many micro regressions, but not in the aggregated estimates, and we have included dummies, where possible, to reflect specialty differences within the overall groups.

The 1980 mean values, standard deviations, and ranges for many variables in the primary care sample are shown in Table 5-7. Because the physician availability and secondary data are weighted market-area averages, only fee and use data are given for GSs and OBGYNs in Table 5-8. The variables are defined in Table 5-9.

Tables 5-7 and 5-8 reflect the comprehensiveness of the claims data. The means for total nominal Blue Shield charges per physician are substantial: over $30,000 for PCs; over $44,000 for GSs; and nearly $60,000 for OBGYNs. The averages for total RVUs delivered and unique patient counts indicate also that the fee and charge data are derived from large numbers of patients, e.g., 374 patients per PC physician.

Table 5-7

MEANS, STANDARD DEVIATIONS, MINIMUM AND MAXIMUM VALUES FOR SELECTED VARIABLES FOR 2903 PRIMARY CARE PROVIDERS: 1980

Variable	Mean	Std. Dev.	Min	Max
TNC	31355	4352	515	934934
RVU	2199	2788	52	52576
PAT	374	460	10	7831
Q	6.91	5.12	0.76	63.44
NC	13.53	2.85	7.21	22.98
RC	8.67	1.75	4.80	14.37
NP	10.63	1.50	4.50	15.31
RP	6.82	0.93	2.82	9.86
NY	8479	1679	5494	11704
Y	5419	945	3679	7318
ED	11.96	0.31	11.39	12.45
URB	73.8	20.0	20.7	95.0
FEM	52.9	0.9	51.8	55.1
MINOR	16.0	13.3	1.3	35.8
LT5	9.0	0.6	7.5	10.1
OV65	8.3	1.6	5.6	12.8
BCBSM	52.0	14.7	17.7	69.2
MEDICAID	4.7	1.9	2.2	7.3
W	207	22	149	231
DRT	10.3	3.1	5.5	17.1
LORT	460	74	342	814
MD/POP	13.88	4.10	8.53	22.71
MD/EPOP	13.32	2.57	9.26	18.98
PC/POP	3.08	0.44	2.36	4.22
PC/EPOP	5.09	1.26	3.44	9.18
GS/POP	1.29	0.28	0.78	1.86
GS/EPOP	1.38	0.55	0.86	2.63
OB/POP	1.05	0.52	0.36	2.22
OB/EPOP	1.17	0.85	0.31	3.15
BED/POP	4.68	1.01	2.60	7.51
BED/EPOP	4.77	0.85	2.48	6.89

Table 5-8

MEANS, STANDARD DEVIATIONS, MINIMUM AND MAXIMUM VALUES FOR SELECTED VARIABLES FOR TWO SPECIALTY GROUPS: 1980

Variable	Mean	Std. Dev.	Min	Max
		General Surgeons (N=782)		
Total Nominal Charges ($)	44,114	45,563	670	473,100
Total RVUs	2,757	2,648	52	28,022
Patients	228	412	10	9895
Q	14.61	6.97	1.52	85.04
NC	15.38	3.17	8.80	25.11
RC	9.86	1.95	5.71	15.83
NP	12.22	1.63	7.72	18.70
RP	7.85	1.02	4.86	12.62
		Obstetricians - Gynecologists: (N = 611)		
Total Nominal Charges ($)	56,698	47,883	955	507,065
Total RVUs	3,801	2,940	63	36,037
Patients	262	236	10	2621
Q	16.70	6.28	0.64	33.78
NC	15.39	2.59	9.58	25.02
RC	9.82	1.56	6.02	15.65
NP	12.36	1.21	4.58	17.02
RP	7.89	0.78	2.86	11.09

Table 5-9

VARIABLE DEFINITIONS

Variable	Definition
TNC	Total nominal charges per physician ($)
RVU	Total RVUs per physician
PAT	Total unique patients per physician
Q	RVUs per unique patient
NC	Nominal charge per RVU ($)
RC	Real charge per RVU ($)
NP	Nominal payment per RVU ($)
RP	Real payment per RVU ($)
NY	Nominal per capita income ($)
Y	Real per capita income ($)
ED	Mean school years
URB	Percent of population urban
FEM	Percent of population female
MINOR	Percent of population minority
LT5	Percent of population less than or equal to 5 years of age
OV65	Percent of population greater than or equal to 65 years of age
BCBSM	Percent of population covered by Blue Shield
MEDICAID	Percent of population covered by Medicaid
W	Real average weekly wages ($)
DRT	Age adjusted mortality per 1,000 population
LORT	Workmen's compensation work loss days per 1,000 employees
MD/EPOP	Physicians per 10,000 effective population
MD/POP	Primary Care Physicians-per 10,000 effective population
PC/POP	Primary Care Physicians-per 10,000 actual population
PC/EPOP	Physicians per 10,000 effective population
GS/POP	General Surgeons per 10,000 actual population
GS/EPOP	General Surgeons per 10,000 effective population
OB/POP	Obstetricians - Gynecologists per 10,000 actual population
OB/EPOP	Obstetricians - Gynecologists per 10,000 effective population
BED/POP	Hospital beds per 1,000 actual population
BED/EPOP	Hospital beds per 1,000 effective population

Table 5-10 contains simple correlation coefficients for each sample between NC, RC, Q and selected variables. In the primary care sample, and except for some secondary variables such as urbanization, per capita income levels, and the Blue Shield penetration rate, the simple correlation coefficients tend to be low. With respect to the availability variables, there are stronger positive correlations between nominal or real charges and the effective physician-population ratio and effective primary care-population ratios than with the respective actual availability ratios.

There are positive correlations between fees and the actual and effective surgeon-population ratios for general surgeons, although the correlation coefficients are very low, especially for real charges. The coefficients are negative, though again quite low, with respect to Q.

In the OBGYN sample there is a positive correlation between nominal charges and OBGYN availability and very slight positive and negative relationships, respectively, between OB/POP and OB/EPOP and real charges per RVU. There are strong inverse relationships between Q and the two OBGYN availability measures.

Over the three samples, the simple correlation coefficients indicate positive, though not strong, relationships between the respective availability ratios and charges and negative, weak correlations with RVUs per patient, except for the OBGYN group. The direction of these relationships is consistent with the equilibrium fee model, but is contrary to the disequilibrium hypotheses supported with aggregated data. Of course, multivariate regressions are designed to separate the effects of the many independent variables to be included, and the partial regression coefficients could take on signs that are different from those given above. One concern is that the simple correlation coefficients between the availability variables and the dependent variables in the models tend to be low, which reduces the prospects of finding significant regression coefficients.

Table 5-10

SIMPLE CORRELATION COEFFICIENTS BETWEEN NOMINAL AND REAL CHARGES PER RVU; RVUs PER PATIENT, AND SELECTED VARIABLES: 1980

	Primary Care (N=2903)			General Surgeons (N=782)			Obstetricians Gynecologists (N=611)		
	NC	RC	Q	NC	RC	Q	NC	RC	Q
NC	1.00			1.00			1.00		
RC	0.99	1.00		0.99	1.00		0.98	1.00	
Q	0.06	0.07	1.00	0.20	0.22	1.00	-0.08	-0.04	1.00
MD/POP	0.12	0.05	-0.03	0.17	0.09	-0.02	0.14	0.06	-0.20
MD/EPOP	0.21	0.13	-0.01	0.21	0.12	-0.06	0.36	0.26	-0.20
PC/POP	-0.04	-0.01	0.01	-0.12	-0.10	0.02	0.01	0.04	0.14
PC/EPOP	0.16	0.11	-0.01	0.11	0.05	-0.04	0.34	0.28	-0.09
GS/POP	0.10	0.04	-0.01	0.13	0.08	-0.06	0.08	0.02	-0.17
GS/EPOP	0.06	0.01	-0.02	0.11	0.06	-0.02	0.01	-0.05	-0.16
OB/POP	0.13	0.05	-0.02	0.18	0.10	-0.03	0.11	0.03	-0.21
OB/EPOP	0.09	0.03	-0.02	0.15	0.09	-0.02	0.06	-0.01	-0.19
BED/POP	0.02	0.02	0.03	-0.05	-0.05	-0.01	0.11	0.11	0.08
BED/EPOP	-0.03	-0.04	0.06	-0.05	-0.07	0.03	-0.04	-0.05	0.02
Y	0.23	0.13	-0.04	0.30	0.19	-0.04	0.25	0.13	-0.29
URB	0.32	0.20	0.00	0.35	0.23	-0.07	0.44	0.31	-0.28
ED	-0.03	-0.07	-0.03	0.01	-0.01	0.04	-0.15	-0.19	-0.03
BCBSM	0.31	0.20	-0.05	0.33	-0.21	-0.06	0.35	0.21	-0.33

5.3.1 Primary Care

Ordinary least squares estimates of the models for primary care providers are given by regressions (1)-(3) in Table 5-11.[6] Regression (1) tests the equilibrium model while (2) and (3) are estimates of the disequilibrium process. It turns out that (1) and (2) are almost identical because (2), which includes the lagged real charge, indicates a very rapid movement to the equilibrium real charge. Both regressions show a significant positive effect of the availability of primary care physicians, thus supporting the "Reinhardt test", and negative and significant effects of other physicians and hospital beds indicating competitive effects.

As for RVUs per patient, there are few significant variables in regression (3) at the five percent level.[7] The penetration rate is, surprisingly, strongly negative, as are RC and FEM, while LORT (the work loss rate) and BED/EPOP, as expected, have positive significant signs. The signs of the physician availability variables are negative, though not significant, and contrary to the hypotheses that primary care physicians would try to induce more services and provide more intensive care as their availability increases.

The physician specialty dummy variables are interesting. In both the fee and use regressions there are significant differences compared to GPs--the base group. These differences corroborate hypotheses developed elsewhere (Wennberg and Gittlesohn 1980, 1982) that style of practice and training are very significant determinants of expenditures for care.

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[6] The regressions are unweighted. Regressions weighted by RVUs produce very similar results.

[7] One tail-tests are used for predicted signs; two-tail tests, otherwise.

Table 5-11

FEE AND UTILIZATION REGRESSIONS FOR PRIMARY CARE PROVIDERS

Dep. Var/ Ind. Var	OLS (1) RC	(2) RC	(3) Q	2SLS (4) RC	(5) Q
CONST	3.534	3.089	0.787	3.210	1.994
	(1.47)	(2.10)	(0.018)	(1.79)	(0.36)
RC			-0.059		-0.456[e]
			(2.40)		-0.132
LRC		0.038		0.038	
		(6.27)		(6.30)	
Y	0.099	0.092	-0.196	0.115	-0.152
	(2.29)	(2.13)	(-1.51)	(2.38)	(-1.00)
ED	-0.941	-0.810	0.491	-0.808	0.161
	(-2.30)	(-1.98)	(0.40)	(-1.74)	(0.11)
URB	-0.032	0.027	-0.000	-0.015	-0.012
	(-1.05)	(-0.90)	(-0.00)	(-0.46)	(-0.13)
FEM	0.890	0.838	-3.59	0.483	-3.178
	(2.81)	(2.65)	(-3.79)	(0.93)	(-2.27)
MINOR	-0.006	-0.006	0.036	-0.017	-0.036
	(0.62)	(-0.63)	(-1.22)	(-1.42)	(-1.01)
LT5	-0.383	-0.364	0.066	-0.407	-0.076
	(-3.53)	(-3.36)	(0.20)	(-2.71)	(-0.20)
OV65	-0.136	-0.115	0.020	-0.153	-0.027
	(-1.71)	(-1.44)	(0.08)	(-1.77)	(-0.10)
BCBSM	0.021	0.022	-0.324	0.035	-0.319
	(1.42)	(1.48)	(-7.26)	(1.41)	(-5.02)
MEDICAID	0.012	0.013	0.115	0.044	0.114
	(0.52)	(0.53)	(1.62)	(1.11)	(0.95)
PC/EPOP	0.077	0.075	-0.092	0.017[e]	-0.051[e]
	(3.30)	(3.22)	(-1.32)	(0.25)	(-0.28)
OMD/EPOP	-0.045	-0.048	0.071	-0.017	0.045
	(-1.59)	(-1.69)	(0.84)	(-0.32)	(0.28)
BED/EPOP	-0.088	-0.089	0.170	-0.044	0.136
	(-3.04)	(-3.07)	(1.96)	(-1.61)	(1.51)

Table 5-11 - Con't

FEE AND UTILIZATION REGRESSIONS
FOR PRIMARY CARE PROVIDERS

Dep. Var/ Ind. Var	OLS (1) RC	OLS (2) RC	OLS (3) Q	2SLS (4) RC	2SLS (5) Q
W	0.358 (5.83)	0.352 (5.72)	0.103 (0.56)	0.263 (3.50)	0.253 (1.01)
DRT	-0.129 (-1.50)	-0.013 (-1.57)	0.023 (0.89)	-0.019 (-2.00)	0.017 (0.56)
LORT	-0.015 (-0.97)	-0.012 (-0.77)	0.090 (2.01)	0.000 (0.02)	0.086 (1.67)
D-FP	0.076 (15.57)	0.075 (15.58)	-0.016 (-1.11)	0.076 (15.94)	0.014 (0.46)
D-IM	0.099 (27.08)	0.096 (25.85)	0.319 (28.40)	0.085 (25.78)	0.358 (9.95)
D-PED	0.012 (2.28)	0.009 (1.63)	-0.057 (-3.65)	0.008 (1.58)	-0.053 (-3.21)
D-77	0.013 (2.17)	0.011 (1.99)	0.071 (4.10)	0.014 (1.93)	0.075 (3.39)
D-78	0.036 (5.53)	0.034 (5.25)	0.057 (2.91)	0.038 (3.82)	0.070 (2.18)
D-79	0.027 (4.09)	0.023 (3.58)	0.026 (1.33)	0.022 (2.45)	0.035 (1.23)
D-80	0.037 (4.01)	0.035 (3.74)	0.002 (0.06)	0.040 (3.07)	0.014 (0.34)
R^2	0.134	0.136	0.099	0.135	0.097

NOTE: There are 14758 observations; the t-statistics are shown in parentheses; all variables except for the time and specialty dummies are measured in logarithms; and e denotes the endogenous variables in 2SLS estimates.

The two stage-least square estimates of the fee and use equation are shown in regressions (4) and (5), respectively. Here RC, Q, and PC/EPOP are treated as endogenous variables. In individual physician analysis, the physician-population ratio could be considered exogenous, in which case the fee and use equations form a recursive system that, assuming the error terms to be independent, can be estimated by OLS as given in regressions (2) and (3). However, for 2SLS estimates, we developed an equation to represent primary care-physician location. The independent variables are: RC, Y, ED, URB, FEM, MINOR, LT5, OV65, BCBSM, OMD/EPOP, BED/EPOP, W, DRT, LORT, the unemployment rate, the number of hospitals, and persons per square mile. Even though equations of this type, had very high R^2s (approximately 0.87), many variables entered with unexpected signs. Thus, some caution is required before placing too much reliance on the 2SLS estimates.

The major differences in the two sets of findings are that the physician-availability variables are not significant in either regression; that is, physician availabililty has no clear positive or negative effects on either the fees or intensity of practice among primary care physicians. Before examining whether these conclusions hold for the more specialized providers, as the aggregated analysis in Chapter 4 suggested, we elaborate on the use of effective rather than actual availability ratios.

The actual physician availability measures were positive and significant in the equivalent of regressions (1) and (2) in Table 5-11, as compared with a significant or close to significant negative effects for OMD/EPOP, as expected. In the equivalent to regression (3), both availability variables had significant negative coefficients, while neither of the effective ratios was significant. In 2SLS estimates, both coefficients were positive with similar t-values of 1.3 in the fee equation; and again, both were negative with similar t-ratios of -1.5 in the intensity equation. Thus, the adoption of the PC/EPOP variable has eliminated an apparent significant or near significant effect on Q of the availability of primary care physicians, although it is still not positive as had been expected.

5.3.2 General Surgeons and Obstetricians--Gynecologists

The model estimates for surgeons and OBGYNs are shown in Table 5-12. As might have been suspected from the simple correlation coefficients in Table 5-10, only the OBGYN regressions tend to be robust. In either the OLS or 2SLS fee regressions for GSs, and apart from the positive significant time trend, only URB (+), MINOR (-) AND W (+) are significant. In the use estimates, ED, URB, FEM, LT5, and OV65, are consistently significant and negative in both estimates. Interestingly, the Blue Shield penetration rate is not positive, unlike the findings in our casual data analysis and aggregated regressions.

Most important, however, the availability of general surgeons has no clear impact on either fees or use.[8] Neither does the availability of hospital beds. The availability of primary care physicians, which is included as a substitute measure for GSs, has a significant impact on the intensity measure of use. These findings for use are especially surprising given the strong evidence of a surgeon availability effect in the aggregated regressions.

For OBGYNs, the R^2s are much higher than for the other two groups. However, the sign of OB/EPOP is correct and significant only in the 2SLS estimate of Q where it contradicts the no-inducement finding in the aggregated OBGYN regressions. The actual OBGYN-population ratio was significant also in the corresponding regression; but no other physician-availability coefficients were significant in any of the OLS or 2SLS regressions. Another finding in these regressions is that differences in training and education, as reflected in the two Doctor of Osteopathics (D.O.) dummies (MDs represent the base group), have very significant effects on the amounts of care rendered.

5.3.3 Changes in Fees and Use

The study attempted also to determine whether the physician-availability variables and changes in these variables between 1976 and 1980 affected the percent changes in the respective fees between 1976 and 1980. Because a dynamic fee model cannot be estimated with one cross-section, only the equilibrium fee equation and the use equation were tested. The specifications are almost the same as the models described above with the exceptions that: (i) there are no year dummies, (ii) a simple linear, rather than double-log form, was used because of negative values among the percent changes; (iii) percent changes in the relevant availability indices were added; and (iv) one variable (DRT) was dropped from the regressions because it caused severe multicollinearity problems.

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8 In equations with the actual ratios, the actual primary care-population ratio had a significant sign in the 2SLS fee equation. All other availability coefficients in the four OLS and 2SLS estimates were insignificant.

Table 5-12

FEES AND UTILIZATION REGRESSIONS FOR GENERAL SURGEONS AND OBSTETRICIANS/GYNECOLOGISTS

	OLS				2SLS			
	General Surgeons		OB/GYN		General Surgeons		OB/GYN	
Dep. Var/ Ind. Var	(1) RC	(2) Q	(3) RC	(4) Q	(5) RC	(6) Q	(7) RC	(8) Q
CONST	-3.372 (-1.10)	31.681 (4.01)	-3.406 (-1.28)	40.318 (5.07)	-0.494 (-0.15)	31.841 (3.14)	-2.096 (0.57)	83.401 (3.13)
RC*		0.643 (5.90)		0.250 (4.66)		-0.652[e] (-1.11)		6.014 (1.04)
LRC	0.012 (0.93)		-0.003 (-0.24)		0.016 (1.24)		-0.002 (-0.18)	
Y	0.022 (0.24)	0.106 (0.43)	0.262 (3.24)	-0.207 (-0.85)	(0.004) (0.04)	0.094 (0.30)	0.234 (2.39)	-2.182 (-1.62)
ED	0.365 (0.43)	-5.950 (-2.75)	-0.123 (-0.17)	-7.834 (-3.58)	-0.278 (-0.31)	-6.470 (-2.33)	-0.172 (-0.18)	-13.704 (-2.13)
URB	0.138 (2.22)	-0.531 (-3.33)	0.145 (2.46)	-0.872 (-4.98)	0.108 (1.80)	-0.463 (-2.51)	0.119 (1.55)	-2.160 (-2.33)
FEM	-0.353 (-0.50)	-3.883 (-2.15)	-2.932 (-4.77)	-3.686 (-1.99)	-0.482 (-0.70)	-5.598 (-2.80)	-2.994 (-4.78)	11.425 (0.75)
MINOR	-0.064 (-2.84)	0.122 (2.10)	-0.090 (-4.99)	0.180 (3.36)	-0.066 (-2.84)	0.044 (0.57)	-0.091 (-5.02)	0.657 (1.20)
LT5	-0.159 (-0.62)	-1.860 (-2.82)	-0.569 (-2.33)	-3.400 (-4.65)	-0.026 (-0.11)	-2.200 (-3.29)	-0.658 (-2.20)	-1.929 (-0.58)
OV65	0.215 (1.28)	-1.722 (-3.99)	0.341 (2.35)	-1.992 (-4.60)	0.074 (0.42)	-1.592 (-3.05)	0.289 (1.63)	-4.973 (-2.47)
BCBSM	-0.049 (-1.42)	-0.053 (-0.60)	-0.125 (-4.20)	-0.168 (-1.87)	-0.051 (-1.48)	-0.100 (-0.96)	-0.126 (-4.22)	0.553 (0.66)
MEDICAID	0.025 (0.50)	0.094 (0.72)	0.027 (0.69)	-0.122 (-1.03)	0.051 (0.96)	0.164 (1.04)	0.034 (0.82)	-0.126 (-0.37)
GS/EPOP	0.039 (1.00)	0.025 (0.25)			0.063[e] (1.17)	0.176[e] (1.04)		
OB/EPOP			-0.018 (-1.30)	-0.013 (-0.31)			-0.000[e] (-0.02)	0.430[e] (1.87)

Table 5-12 - Con't

FEES AND UTILIZATION REGRESSIONS FOR GENERAL SURGEONS AND OBSTETRICIANS/GYNECOLOGISTS

	OLS				2SLS			
	General Surgeons		OB/GYN		General Surgeons		OB/GYN	
Dep. Var/ Ind. Var	(1) RC	(2) Q	(3) RC	(4) Q	(5) RC	(6) Q	(7) RC	(8) Q
PC/EPOP	0.024	-0.154	0.137	-0.203	0.018	-0.190	0.134	-1.117
	(0.58)	(-1.48)	(3.54)	(-1.76)	(0.46)	(-1.81)	(3.42)	(-1.10)
BED/EPOP	-0.016	0.127	-0.083	0.114	0.012	0.018	-0.095	0.261
	(-0.33)	(0.99)	(-1.78)	(0.82)	(0.26)	(0.100)	(-1.83)	(0.40)
W	0.606	-1.533	0.390	-0.541	0.575	-0.733	0.420	-2.306
	(4.61)	(-4.54)	(3.13)	(-1.46)	(4.27)	(-1.33)	(3.04)	(-0.81)
DRT	-0.23	0.246	-0.022	0.223	-0.004	0.264	-0.011	0.559
	(-1.10)	(4.17)	(-1.36)	(4.58)	(-0.15)	(3.01)	(-0.38)	(2.87)
LORT	0.013	-0.074	0.098	0.031	0.004	-0.086	0.093	-0.595
	(0.40)	(-0.91)	(3.33)	(0.68)	(0.13)	(-0.83)	(2.98)	(-1.17)
D-77	0.031	0.048	-0.002	0.068	0.034	0.099	0.001	0.135
	(2.46)	(1.50)	(-0.17)	(2.19)	(2.68)	(2.31)	(0.09)	(1.73)
D-78	0.040	0.047	-0.006	0.023	0.046	0.118	-0.002	0.147
	(2.66)	(1.21)	(-0.55)	(0.65)	(2.86)	(2.06)	(-0.13)	(1.50)
D-79	0.036	0.005	-0.018	-0.037	0.040	0.076	-0.016	0.097
	(2.32)	(0.13)	(-1.63)	(-1.13)	(2.31)	(1.28)	(-1.37)	(0.91)
D-80	0.078	-0.046	0.048	-0.130	0.083	0.082	0.051	-0.329
	(3.47)	(-0.80)	(2.80)	(-2.57)	(3.33)	(0.91)	(2.79)	(-1.02)
D_1			-0.010	0.445			-0.010	0.500
(GYN-D.O)			(-0.30)	(4.36)			(-0.30)	(2.17)
D_2			-0.005	-0.228			-0.005	-0.194
(OB-D.O.)			(-0.48)	(-6.75)			(-0.46)	(-2.46)
R^2	0.091	0.097	0.199	0.137	0.094	0.036	0.198	0.032
N	4054	4054	3107	3107	4014	4014	3107	3107

NOTE: The t-statistics are shown in parentheses; all variables except for the time and specialty dummies are measured in logarithms; and e denotes the endogenous variable in 2SLS estimates.

Only the coefficients for the availability variables are shown in Table 5-13. Generally, the R^2s are very low because few secondary variables were significant. This fact is not surprising and indicates that the rates of change in fee and use are not closely related to changes in demographic and other characteristics.

The results of the regressions are mixed. For primary care, the effective primary care-population ratio has a negative, though not quite significant, effect on the percent of change in real charges, but the percent of change in availability has a strong positive effect. Both the availability and increase in the availability of other physicians have highly significant effects on the change in fees. In the use equation, the effect of PC/EPOP is positive and significant. The remaining coefficients are negative and insignificant.

Among general surgeons, all the coefficients are negative and either significant or close to significant. The evidence indicates that a greater availability of general surgeons or substitutes for general surgeons tends to reduce the rate of increase in both fees and the intensity with which care is provided--at least per patient. In the OBGYN sample, a greater availability of both OBGYNs and PCs increases the growth of fees, but growth of PCs has a negative effect. No physician-availability coefficient is significant in the use equation.

5.3.4 Summary and Conclusion

The econometric estimates fail to reveal a consistent pattern of availability effects. Ordinary-least-squares estimates support the "Reinhardt Test" for primary-care providers, although the availability of other physicians as well as hospital beds have competitive negative effects on real fees. There are no physician-availability effects on our measure of use. There were none detected for either fees or use among general surgeons--seemingly the most likely sample to support our hypotheses. The OBGYN estimates conform most closely to the disequilibrium model, though the evidence of inducement effects for this specialty contradicts the aggregated findings.

Despite these inconsistencies (further examined below), the estimates have produced several conclusions. First, some secondary variables exhibit consistent patterns over the many estimates and conform to the aggregated estimates. These include significant negative effects of education on fees and, in the case of the two specialized groups, GS and OBGYN, significant negative effects on use as well as on a per patient basis. Increasing urbanization also shows a negative effect on use in these specialized groupings. The negative effects of the availability of beds on fees, the positive effects of wages on fees, and the effects of the age variables are also consistent among the disaggregated regressions, as well as compatible with previous findings.

Table 5-13

ESTIMATES OF PERCENT CHANGES IN FEES AND UTILIZATION FOR THREE SPECIALTY GROUPS

	Primary Care		General Surgeons		Obstetricians Gynecologists	
Dep. Var/ Ind. Var	%RC	%Q	%RC	%Q	%RC	%Q
PC/EPOP	-0.348 (-1.54)	2.956 (2.39)	-0.961 (-1.96)	-2.411 (-1.72)	3.462 (3.16)	3.411 (0.75)
OMD/EPOP	-0.534 (2.46)	-0.964 (-0.81)				
GS/EPOP			-1.957 (-1.81)	-1.796 (-0.58)		
OB/EPOP					6.983 (2.65)	6.627 (0.56)
% PC/EPOP	0.275 (3.09)	-0.761 (-1.56)	-0.528 (-2.78)	-1.731 (-3.18)	-0.541 (-2.10)	-0.729 (-0.67)
% OMD/EPOP	-0.456 (-4.07)	-0.050 (-0.08)				
% GS/EPOP			-0.332 (-1.54)	-0.938 (-1.51)		
% OB/EPOP					0.139 (0.92)	-0.355 (-0.53)
N	2903	2903	782	782	611	611
R^2	0.024	0.025	0.072	0.059	0.095	0.01

NOTE: The other independent variables are not shown in the table and % indicates percent change between 1976 and 1980.

The major differences between the individual physician and aggregated estimates are in the Blue Shield penetration rate and income levels. The aggregated regressions have a consistently strong positive effect of the Blue Shield market share on fees and to some extent on use rates, which do not arise here. Similarly, the positive effect of income on use previously found is not supported in the micro regressions. Generally, there is greater overall consistency for the micro and aggregated estimates in fee regressions than in the use estimates, not surprisingly, because of differences in the respective use measures. These more prevalent discrepancies suggest possible problems with the intensity measure that was developed--an area that will be addressed below.

The results indicate also the importance of accounting for specialty differences in the intensity regressions. Moreover, the dummies indicate significant differences in fees among the primary care provider groups. Although the data could not be adjusted for differences in case-mix (the tracer analyses will include such adjustments), the evidence strongly suggests that differences in physicians' style of practice and training lead to significant disparities in standards and style of care. The intensity indices could be valuable also in selecting physicians to participate in various preferred provider programs as a means of containing costs, particularly through decreases in the amount of care that they might be expected to render.

Although the individual physician models have provided some interesting findings, and the extensive data base that was developed should be considered an important resource for future research, the estimates raise two serious questions. Why, when both the casual and analytical aggregated analyses show very large increases in use and a distinct availability effect, does the micro approach fail to support these results? Which set of results is more useful?

Although the micro-regressions did not substantiate the mechanism by which inducment would be manifested at the individual physician level, we believe that the increase in aggregated use associated with greater physician availability is more relevant to the current national policy goal of controlling expenditures. The use measure developed for the individual physician regressions has severe limitations. The raw individual physician data already suggested that the intensity measure developed did not have the same growth pattern as the aggregated per capita measure, and simple correlations between both use and other variables were low. Thus it is not surprising that the regression R^2s were low and that there would be few consistently significant availability coefficients.

We had also hypothesized that, other things being equal, an increase in competition would reduce the size in terms of patients of the typical physician's practice and that the physician would provide a more intensive level of care for his remaining patients. However, physicians could induce in a form that would actually lower the intensity of care per unique patient. For example, physicians in high concentration areas

may be providing more discretionary care of a less serious nature which reduces the average value of Q. On the other hand, some specialists, such as general surgeons, may be providing more general care in high density areas, again reducing the intensity of the care they provide as compared to their counterparts in lower density areas who may be treating relatively more serious cases. In addition, and unrelated to inducement, the aggregated data include various lab procedures which to a greater extent may be sent out by physicians (and, thus not included in their direct claims) in high density areas, i.e., the unbundling problem.

Greater access in high use areas may also result in beneficiaries visiting a larger number of distinct providers. Evidence from the tracers in Chapter 7 is consistent with these hypotheses. The market area differences in the incidence of the tracers, especially the high rates for Detroit, Flint, and Pontiac, are striking and, particularly, for urinary tract infection, would not seem to be the result of demographic or health status differences. The incidence of urinary tract infection in Detroit is at least 3 times greater than rates in 12 other markets. Thus it would appear that more patients visit physicians in high use areas as compared to other areas. The higher per-beneficiary expenditures on office visits, lab work, and consultations also suggest that patients in the high use areas may be treated by a larger number of distinct providers. These two elements, more patients initiating visits and visiting more providers, could explain the discrepancy between use per patient per physician and use per capita.

Chapter 6

MEDICARE DATA AND ANALYSIS

Introduction

This chapter will focus on three areas. The first is a cross-sectional descriptive examination of aggregated Medicare (Part B) claims data. Because of claims data limitations, we have been able only to develop indices comparable in scope to the Blue Shield indices for 1979 and 1980. Data are available from 1975 on a limited subset of 56 Medicare procedures. These data are used for the micro physician samples described in the fourth section of this chapter and for the econometric analysis found in the fifth section.

6.1 Aggregated Data

This section examines cross-sectional Medicare B data for 1980. In addition to fee and use indexes, considerable information has been gathered on Medicare assignment rates. A description and discussion of our findings are included.

The largest market basket of Blue Shield services contains 424 procedures which account for approximately 60 percent of all Blue Shield charges. For consistency, a comparable Medicare B market basket containing 311 procedure codes was selected.[1] These 311 procedure codes account annually for approximately 33 percent of all Medicare B charges. The smaller figure reflects the different medical use of the two populations.

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[1] The discrepancy arises out of differences in coding, not in the scope of services. The procedures and the conversion table used for both Blue Shield and Medicare is contained in Appendix C.

To increase the accuracy of the indices, the methods described in Chapter 3 were used to define market areas and estimate the residual bordercrossing between markets. Table 6-1 shows the allocation of counties to their respective markets, which are identical to those defined for Blue Shield beneficiaries, and compares Blue Shield and Medicare within county and within central place utilization. While the two patterns are very similar, there is clearly a higher within-county use for Medicare population. Less mobility among the elderly and possibly more established long-term relationships with providers are likely to account for less bordercrossing.

Table 6-1

MEDICARE AND BLUE SHIELD MARKETS

County	Central Place	% Within County		% Within Central Place		Sub-Central Place	% Within Sub-Central Place	
		BS	MED	BS	MED		BS	MED
Arenac	Bay	23.51	33.84	23.26	19.77			
Bay*	Bay	72.96	82.54	--	--			
Huron	Bay	57.00	61.98	8.90	7.64			
Tosco	Bay	42.27	40.29	4.31	6.94			
Ogemaw	Bay	40.86	38.74	7.45	10.64			
Alcona	Emmett	8.29	10.29	8.86	--	Alpena	24.78	39.09
Alpena+	Emmett	65.79	71.95	11.63	11.40			
Charlevoix	Emmett	37.95	33.04	45.67	52.90			
Cheboygan	Emmett	33.28	46.32	25.62	40.38			
Chippewa	Emmett	41.91	67.64	30.38	20.32			
Emmett*	Emmett	80.85	88.67	--	--			
Mackinac	Emmett	7.65	8.59	26.62	39.81			
Montmorency	Emmett	27.39	8.87	11.87	14.40	Alpena	16.39	26.82
Otsego	Emmett	46.58	41.41	20.48	34.78			
Presque Isle	Emmett	56.53	39.93	18.55	27.68	Alpena	12.65	21.17
Genesee*	Genesee	91.83	93.16	--	--			
Lapeer	Genesee	43.35	49.35	20.82	18.49			
Sanilac	Genesee	34.74	38.59	12.96	--			
Shiawassee	Genesee	35.13	50.83	33.84	21.46			
Antrim	Grand Traverse	27.86	22.05	33.10	48.97			
Benzie	Grand Traverse	46.99	46.71	39.62	37.06			
Crawford	Grand Traverse	48.30	45.76	11.60	18.67			
Grand Traverse*	Grand Traverse	82.70	84.99	--	--			
Kalkaska	Grand Traverse	22.80	21.23	42.59	54.33			
Leelanau	Grand Traverse	38.83	43.71	48.04	49.62			
Manistee	Grand Traverse	62.00	67.70	16.80	11.54			
Missaukee	Grand Traverse	29.01	35.02	8.85	9.69			
Oscoda	Grand Traverse	26.75	22.56	2.67	1.71			
Roscommon	Grand Traverse	21.34	18.84	7.70	11.75			
Wexford	Grand Traverse	61.77	55.63	17.65	21.49			
Clinton	Ingham	33.96	33.12	45.28	38.64			
Ingham*	Ingham	88.40	88.42	--	--			
Eaton	Ingham	25.87	29.34	56.50	51.79			

Table 6-1 (Cont'd)

County	Central Place	% Within County		% Within Central Place		Sub-Central Place	% Within Sub-Central Place	
		BS	MED	BS	MED		BS	MED
Branch	Kalamazoo	53.28	60.27	13.16	12.58	Calhoun	13.95	14.11
Calhoun+	Kalamazoo	76.06	82.62	13.13	9.06			
Cass	Kalamazoo	39.77	48.94	16.68	14.91			
Kalamazoo*	Kalamazoo	88.40	91.45	--	--			
St. Joseph	Kalamazoo	48.50	56.99	32.66	34.43	Calhoun	--	2.89
Van Buren	Kalamazoo	35.27	40.31	40.18	39.20			
Allegan	Kent	25.59	35.01	25.04	15.83			
Barry	Kent	38.41	41.17	25.12	21.90			
Ionia	Kent	45.17	37.18	18.26	34.01			
Kent*	Kent	92.88	94.99	--	--			
Lake	Kent	--	4.21	14.44	17.28			
Mecosta	Kent	41.88	46.07	22.63	23.94			
Montcalm	Kent	56.39	50.79	24.01	28.55			
Newaygo	Kent	34.03	38.40	37.16	38.40			
Osceola	Kent	30.47	27.09	18.13	16.10			
Ottawa	Kent	43.63	56.46	36.65	31.39			
Macomb*	Macomb	59.40	53.23	--	--			
St. Clair	Macomb	41.80	64.18	20.48	13.65			
Alger	Marquette	64.90	40.00	24.94	40.38			
Baraga	Marquette	55.53	60.31	19.71	26.67			
Delta	Marquette	46.73	74.64	17.97	16.95			
Dickinson	Marquette	59.35	80.17	7.31	11.16			
Gogebic+	Marquette	46.56	92.59	--	--			
Houghton	Marquette	66.11	75.07	13.55	16.30			
Iron	Marquette	61.10	71.72	13.64	16.18			
Keweenaw	Marquette	--	--	22.62	22.58			
Luce	Marquette	62.72	47.99	26.34	21.01			
Marquette*	Marquette	86.39	95.49	--	--			
Menominee	Marquette	30.83	66.59	--	4.88			
Ontonagon	Marquette	77.71	65.98	10.42	21.50			
Schoolcraft	Marquette	59.08	66.84	19.51	20.55			
Mason	Muskegon	50.81	67.23	12.20	6.46			
Muskegon*	Muskegon	89.42	89.08	--	--			
Oceana	Muskegon	45.95	35.25	28.58	32.75			

Table 6-1 (Cont'd)

County	Central Place	% Within County		% Within Central Place		Sub-Central Place	% Within Sub-Central Place	
		BS	MED	BS	MED		BS	MED
Oakland*	Oakland	72.22	73.20	--	--			
Clare	Saginaw	34.03	31.39	5.05	5.33			
Gladwin	Saginaw	38.64	49.22	7.43	4.74			
Gratiot	Saginaw	49.16	67.04	18.30	3.34			
Isabella	Saginaw	58.93	66.47	2.51	--			
Midland	Saginaw	72.47	77.40	7.62	5.54			
Saginaw*	Saginaw	87.49	88.01	--	--			
Tuscola	Saginaw	29.26	30.64	23.12	22.40			
Hillsdale	Washtenaw	29.67	47.32	12.60	7.51	Jackson	19.34	14.38
Jackson+	Washtenaw	69.89	78.86	14.72	12.04			
Lenawee	Washtenaw	65.56	68.98	21.58	21.55			
Livingston	Washtenaw	33.58	35.55	33.32	32.61			
Washtenaw*	Washtenaw	85.65	90.09	--	--			
Monroe	Wayne	32.96	69.08	35.78	12.10			
Wayne*	Wayne	71.27	70.22	--	--			
Berrien*	Berrien	68.99	89.24	--	--			

* Central Place
+ Sub-Central Place

6.2 Utilization and Fees

Table 6-2 contains the aggregated use and fee indices for 1980. For convenience, the corresponding Blue Shield data, excluding an index comparable to the Medicare reasonable charge, are given in Table 6-3. As discussed in Chapter 3, we provide two measures--the total number of RVUs provided per 1,000 actual population (QA) and the quantity provided per 1,000 population (QE), that incorporates a residual bordercrossing adjustment.

Three fee indices, each in nominal and real terms, are provided for the Medicare market basket. These are the actual charges per RVU, the reasonable charge per RVU, and the payment per RVU. Because of differences in copayments and deductibles, the actual charge is the most reliable index for Medicare and Blue Shield comparisons.

6.2.1 Utilization

Our major descriptive findings with respect to Blue Shield utilization are that:

- o Substantial bordercrossing remains even after market areas have been identified. For example, in 1980 Pontiac (area 11 and Ann Arbor (area 13) were net exporters of services as shown by the ratios of actual to effective use of 39 and 20 percent, respectively. Detroit (area 14) imported 15 percent of its physician services for residents receiving care in other markets. Our corrections for this residual bordercrossing had significant effects on per capita use rates, primarily by narrowing inter-market variations.

- o Despite the reduction in the variation as measured by QE, extraordinary disparities in use remains. Pontiac, with the highest use, had a rate three times that of Marquette (area 9), the market with the lowest rate. However, even if one were to overlook such extreme cases, the market average of 7,999 RVUs per 1,000 eligible population in the tri-county Detroit metropolitan area, consisting of Detroit, Pontiac, and Warren, exceeded by 62 percent the mean of 4,939 RVUs of the remaining 12 markets.

- o Use rates are highest in the major metropolitan areas. These markets are typically characterized by high real income levels, population densities, and Blue Cross-Blue Shield of Michigan penetration rates.

Table 6-2

MEDICARE (PART B)

FEES AND USE: 1980

Market Area (Major City)	QA	QE	Nominal Charge Per RVU	Real Charge Per RVU	Nominal Reasonable Charge Per RVU	Real Reasonable Charge Per RVU	Nominal Payment Per RVU	Real Payment Per RVU
1. (Bay City)	12061	14152	16.18	10.80	11.91	7.95	9.29	6.20
2. (Petoskey)	11809	12240	16.24	10.76	12.01	7.96	9.43	6.25
3. (Flint)	17685	18841	17.43	11.41	12.66	8.29	10.00	6.55
4. (Traverse City)	11614	13006	15.25	10.26	11.58	7.79	9.09	6.11
5. (Ingham)	14326	13618	16.71	10.72	12.18	7.82	9.56	6.13
6. (Kalamazoo)	14016	13160	15.18	10.04	11.68	7.73	9.24	6.11
7. (Grand Rapids)	11636	12271	15.20	10.26	11.89	8.02	9.36	6.32
8. (Warren)	17583	18629	18.40	11.50	13.78	8.62	10.83	6.77
9. (Marquette)	9718	9829	14.98	10.83	11.17	8.08	8.73	6.31
10. (Muskegon)	14635	15119	15.73	11.03	11.95	8.38	9.38	6.58
11. (Pontiac)	27697	18685	19.20	12.01	14.37	8.99	11.31	7.07
12. (Saginaw)	14049	14435	16.23	10.67	11.95	7.86	9.40	6.18
13. (Ann Arbor)	17204	14462	16.97	10.66	13.07	8.21	10.33	6.49
14. (Detroit)	17004	19857	18.88	11.81	13.97	8.74	11.06	6.92
15. (St. Joseph)	10306	10537	14.91	9.88	11.18	7.41	8.83	5.85
State Mean	16154	16154	17.59	11.20	13.15	8.38	10.37	6.61
Market Area Mean	14756	14593	16.50	10.84	12.36	8.12	9.73	6.39
Coefficient of Variation	30.1	21.2	8.6	5.7	8.1	5.2	8.3	5.3

NOTE: Real values are expressed in terms of 1974 Detroit area dollars; QA is actual RVU use per 1,000 Medicare population; and QE is effective RVU use per 1,000 Medicare population.

Table 6-3

BLUE SHIELD FEES
AND USE: 1980

Market Area (Major City)	QA	QE	Nominal Charge Per RVU	Real Charge Per RVU	Nominal Payment Per RVU	Real Payment Per RVU
1. (Bay City)	4808	5538	14.25	9.52	11.26	7.52
2. (Petoskey)	4196	4357	13.48	8.93	10.77	7.14
3. (Flint)	7362	7732	15.06	9.86	11.48	7.52
4. (Traverse City)	4067	4526	12.87	8.66	10.41	7.00
5. (Lansing)	6250	5495	13.54	8.69	10.93	7.01
6. (Kalamazoo)	4695	4345	13.16	8.70	10.49	6.94
7. (Grand Rapids)	4437	4591	12.65	8.54	10.55	7.12
8. (Warren)	7470	8000	15.47	9.67	11.55	7.22
9. (Marquette)	2394	2799	12.56	9.08	10.48	7.58
10. (Muskegon)	4708	4709	13.11	9.19	10.41	7.30
11. (Pontiac)	11195	8067	15.32	9.58	11.51	7.20
12. (Saginaw)	5539	5175	13.23	8.70	11.03	7.25
13. (Ann Arbor)	7463	6237	14.16	8.90	10.96	6.89
14. (Detroit)	6715	7931	15.59	9.75	11.30	7.07
15. (St. Joseph)	3282	3766	12.30	8.15	10.22	6.77
State Mean	6892	6892	14.91	9.47	11.30	7.18
Market Area Mean	5642	5551	13.78	9.06	10.89	7.17
Coefficient of Variation	38.6	30.3	8.1	5.7	4.2	3.3

NOTE: Real values are expressed in terms of 1974 Detroit area dollars; QA is actual RVU use per 1,000 BCBSM population; and QE is effeccive RVU use per BCBSM population.

- o The overall state increase in use between 1975 and 1980, not shown in Table 6-3, was very high--38 percent, with much of it coming in the already high use metropolitan areas. In fact, this increase in use, and not real fees, it is the overwhelming contributor to the increasing real expenditures on physician care.

Turning to the Medicare data in Table 6-2, it is apparent that the general patterns are similar to those described above. There are significant variations in use rates, with the major metropolitan areas again leading the way. The bordercrossing patterns are similar also, with the two largest markets, Detroit and Pontiac, continuing as major importers and exporters of care, respectively. However, there are some interesting exceptions. Two of the state's smallest markets, Marquette (9) and St. Joseph (15), import significant amounts of Blue Shield care, but only small amounts of Medicare services. Whether this fact is indicative of decreased mobility among the Medicare population (Marquette is particularly remote), or whether users travel to nearby neighboring states (Wisconsin for Marquette's population, and Indiana and Illinois for St. Joseph's) cannot be determined from our data.[2]

As in the case of Blue Shield use, there also are substantial interarea variations in Medicare utilization, although they are less extreme than shown for the former. The highest effective use rate (Detroit) is double the lowest rate (Marquette). This rate compares with a high-to-low ratio of almost three for Blue Shield. Similarly, the coefficient of variation for the effective Medicare use rate is 70 percent of the corresponding Blue Shield use rate. Further, if Marquette and St. Joseph are treated as anomalies, then, although the major metropolitan areas have substantially higher use rates, the disparities across the state are not nearly as striking as those found for the Blue Shield. The high use Detroit metropolitan area, including Flint, shows a utilization range of 18,629-19,857 RVUs per 1,000 population while the other nine markets, excluding Marquette and St. Joseph, consume between 12,240 and 15,119 RVUs per 1,000 eligible users. Thus, despite lower assignment rates for the latter group (shown below in Section Three) and potentially higher liability for the patient, which may account for some of the differences in use rates, the comparisons with Michigan's Blue Shield pattern indicates that Medicare beneficiaries do not appear to have serious problems with access to physician care.

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[2] Our Blue Shield data include out-of-state services, while our Medicare data do not.

As for growth in use, our Medicare claims data base cannot be used to provide a consistent aggregated time-series between 1975 and 1980 comparable to the Blue Shield indices that we have developed. The partial data, however, suggest that per capita Medicare utilization has been growing rapidly.

6.2.2 Fees

With respect to Blue Shield fees, our two major findings are that:

- o While there are extensive interarea variations in nominal fees per RVU, such variation are markedly reduced once cost-of-living adjustments are included. This finding is particularly true of payments where the highest real payment in 1980 was only twelve percent higher than the market with the lowest real payment.

- o While nominal fees have been growing at rapid rates, not shown in Table 6-3, real charges per RVU have grown only eight percent between 1975 and 1980, and real payments per RVU have actually declined by two percent.

An examination of Medicare fees indicates similar patterns, although the statewide average nominal charge per RVU was eighteen percent higher than the corresponding Blue Shield charge in 1980. We do not know what accounts for this difference. One possibility is that, while the respective procedure codes are nearly identical, they are not equivalent, with Medicare services requiring more care. Thus, the two base RVUs and therefore fees, are not directly comparable without additional adjustments. A second possibility centers on possible problems with uncollectibles. The Blue Shield "assignment" rate is 94 percent, with relatively negligible patient liabilities amounting to 1.3 percent of total statewide charges. Thus, Blue Shield payments per RVU approximate the effective transaction prices. For Medicare services, the patient is liable for twenty percent of the reasonable charges on assigned claims and potentially for more on unassigned ones. If physicians have trouble collecting from some patients, this shortfall may be made up through higher charges paid by or on behalf of others.

As for fee levels, Tables 6-2 and 6-3 show that, while original Medicare charges exceed those for Blue Shield, the interarea patterns are very similar. Table 6-4 confirms the close correspondence between the ratio of nominal to the state mean charges and the general similarities in the respective orders in rank. For Medicare, as for Blue Shield, the major metropolitan areas have the highest nominal charges with small rural markets showing the lowest nominal fees. The highest Medicare nominal charge ($19.20) exceeds the lowest ($14.91) by 29 percent, compared to 28 percent for Blue Shield. The coefficient of variation (8.6) is nearly identical with its Blue Shield counterpart (8.1).

However, once differences for cost-of-living are introduced, the dispersion in fees for all three indices is markedly reduced, as shown by the coefficients of variation. In fact, only 4 markets fail to fall within five percent of the market area mean for real payments. The exceptions include the three largest markets, Detroit, Pontiac and Warren--those that have the highest real fees and the highest utilization rates. For our sample of procedures, these three markets account for 60 percent of the total state payments. Thus, any program to contain costs must be effective in large, high income, urbanized markets rich in health resources. Our data further show that their real fees are approximately ten percent higher than in the rest of the state, but use still is 41 percent higher. Programs directed solely at limiting fees in the tri-county Detroit metro area could exacerbate the use problem when providers are constrained through regulatory mechanisms. They would also be only modestly effective in limiting overall expenditures. On the other hand, if both providers and users can be given incentives to limit use, especially if at the same time these programs place downward pressure on unit costs, the potential for major savings is significantly greater.

Table 6-4

REGULAR BUSINESS AND MEDICARE
FEE AND USE INDEXES

		Nominal Charge State Mean			
	Market	Blue Shield	(Rank)	Medicare	(Rank)
1.	Bay City	0.96	(5)	0.92	(9)
2.	Petoskey	0.90	(8)	0.92	(7)
3.	Flint	1.01	(4)	0.99	(4)
4.	Traverse City	0.86	(12)	0.87	(11)
5.	Ingham	0.91	(7)	0.95	(6)
6.	Kalamazoo	0.80	(10)	0.86	(13)
7.	Grand Rapids	0.85	(13)	0.86	(12)
8.	Warren	1.04	(2)	1.05	(3)
9.	Marquette	0.84	(14)	0.85	(14)
10.	Muskegon	0.88	(11)	0.89	(10)
11.	Pontiac	1.03	(3)	1.09	(1)
12.	Saginaw	0.89	(9)	0.92	(8)
13.	Ann Arbor	0.95	(6)	0.97	(5)
14.	Detroit	1.05	(1)	1.07	(2)
15.	St. Joseph	0.82	(15)	0.85	(15)

6.3 Assignment Rates

As noted above, out-of-pocket costs for Blue Shield subscribers have been minimal because of the extraordinarily high rate of physician participation in Michigan. Charges on non-participating claims amounted only to six percent of total statewide charges in 1980. On the other hand, the assigned Medicare component represents 63 percent of all claims and 73 percent of both total charges and payments. These figures, substantially below the Blue Shield participation rates, are found despite the evidence provided in Tables 6-2 and 6-3, which show that the Medicare reasonable charge per RVU is higher than the Blue Shield payment per RVU (the effective transactions price for Blue Shield services) in every market. The statewide reasonable charge per RVU is sixteen percent higher than the Blue Shield payment per RVU. If physicians were reasonably successful in collecting patient liabilities, a problem alluded to above, they would receive a higher renumeration for providing care to Medicare than to Blue Shield patients, even if they accepted assignment on all Medicare cases.

6.3.1 Frequency Distribution of Assignment Rates

The decisions of physicians to accept assignment and the determinants of market area differences, with special emphasis on relationships between payments levels and assignment rates, are some of the issues that we plan to explore with data compiled at HCFA's request. The nature of these data is shown in Tables 6-5 and 6-6. Table 6-5 indicates for the state as a whole the number of practices falling into each of twelve assignment groups, i.e., practices accepting assignment on 100 percent of their claims, over 90 but less than 100 percent, and so on, as well as information on charges and payments for both the assigned and unassigned components in each group. Table 6-6 expresses these data as total percentage for the state.

The 100 percent assignment group is the largest category by number of practices. Although it contains 21 percent of all the physician provider codes, it accounts for only eight percent of all Medicare charges. Similarly, the zero-assignment rate group has a large number of provider codes (20%) but their total charges represent less than one percent of the total. These are the codes of physicians who either have limited practices, few Medicare patients, or whose provider codes are not used for Medicare.

The 91 to 99 percent assignment rate category is clearly the most important one. The providers in this group account for 52 percent of all assigned claims, and only 1.3 percent of their total charges is unassigned. Significant also is the fact that physicians in the major urban areas, where charges per RVU are the highest, are the most likely to accept assignment. (See Section 6.3.2.)

TABLE 6-5

TOTAL MEDICARE CLAIMS, CHARGES AND PAYMENTS, AND AVERAGES PER

CLAIM BY ASSIGNMENT LEVEL FOR THE STATE OF MICHIGAN, 1980

	Assigned						Unassigned				
Assignment Level	# of Phys.	# of Claims	Total Chgs.	Avg. Chg. Per Claim	Total Payments	Avg. Paymt. Per Claim	# of Claims	Total Chgs.	Avg. Chg. Per Claim	Total Payments	Avg. Paymt. Per Claim
Group 0	3,420	0	0	0.00	0	0.00	94,701	1,744,197	18.41	1,343,596	14.18
Group 1	1,167	21,531	1,392,001	64.65	1,090,955	50.66	419,019	10,855,511	25.90	8,543,501	20.17
Group 10	1,121	83,912	4,941,044	58.88	3,888.594	46.34	461,614	13,819,911	29.93	10,807,773	23.41
Group 20	932	105,825	5,574,259	52.67	4,381,700	41.40	317,929	8,507,704	26.75	6,656,303	20.93
Group 30	852	134,298	6,734,876	50.14	5,280,723	39.32	248,408	5,363,976	21.59	4,179,544	16.82
Group 40	787	138,631	6,929,734	49.98	5,418,157	39.08	167,732	3,351,344	19.98	2,610,531	15.56
Group 50	695	183,501	9,270,094	50.51	7,261,492	39.57	149,296	2,911,136	19.49	2,274,269	15.23
Group 60	725	214,372	9,606,994	44.81	7,531,316	35.13	115,253	2,142,333	18.58	1,676,429	14.54
Group 70	724	215,390	10,031,117	46.57	7,853,708	36.46	72,611	1,385,240	19.07	1,080,998	14.88
Group 80	752	250,639	12,844,900	51.24	10,079,474	40.21	44,938	909,904	20.24	707,967	15.75
Group 90	2,236	1,893,515	57,230,207	30.22	45,758,291	24.16	31,764	738,300	23.24	577,526	18.18
Group 100	3,466	425,030	15,382,428	36.19	12,179,803	28.65	0	0	0.00	0	0.00
STATE TOTAL	16,877	3,666,643	139,937,660	38.16	110,724,214	30.19	2,123,265	51,729,555	24.36	40,368,436	19.01

NOTE: The groups were defined as follows: Group 0 = 0%, Group 1 = (GT 0 and LE 10), Group 10 = (GT 10 and LE 20), Group 20 = (GT 20 and LE 30), Group 30 = (GT 30 and LE 40), Group 40 = (GT 40 and LE 50), Group 50 = (GT 50 and LE 60), Group 60 = (GT 60 and LE 70), Group 70 = (GT 70 and LE 80), Group 80 = (GT 80 and LE 90), Group 90 = (GT 90 and LT 100), Group 100 = 100%. (Where GT = Greater Than, LT = Less than, and LE = Less or Equal.)

Table 6-6

PROPORTION OF ASSIGNED AND UNASSIGNED CLAIMS, CHARGES AND PAYMENTS TO STATE MEDICARE TOTALS BY ASSIGNMENT LEVEL, 1980

Assignment Level	% of Physician	% of Assigned Claims	% of Unassigned Claims	% of Assigned Charge	% of Unassigned Charge	% of Assigned Payment	% of Unassigned Payment
Group 0	20.26%	0.00%	1.64%	0.00%	0.91%	0.00%	0.89%
Group 1	6.91	0.37	7.24	0.73	5.66	0.72	5.59
Group 10	6.64	1.45	7.97	2.58	7.21	2.57	7.15
Group 20	5.52	1.83	5.49	2.91	4.44	2.90	4.41
Group 30	5.05	2.32	4.29	3.51	2.80	3.50	2.77
Group 40	4.66	2.39	2.90	3.62	1.75	3.59	1.73
Group 50	4.12	3.17	2.58	4.84	1.52	4.81	1.51
Group 60	4.30	3.70	1.99	5.01	1.12	4.98	1.11
Group 70	4.29	3.72	1.25	5.23	0.72	5.20	0.72
Group 80	4.46	4.33	0.78	6.70	0.47	6.67	0.47
Group 90	13.25	32.70	0.55	29.86	0.38	30.28	0.37
Group 100	20.54	7.34	0.00	8.03	0.00	8.06	0.00
State	100.00%	66.32%	33.68%	73.02%	26.98%	73.28%	26.72%

NOTES: The % of assigned claims = $\frac{\text{total assigned claims}}{\text{total claims (assigned + unassigned)}}$ and the

% of unassigned claims = $\frac{\text{total unassigned claims}}{\text{total claims (assigned + unassigned)}}$

same for charges and payments.

The one additional striking feature in Table 6-5 is the strong inverse relationship between the average charge per claim and the assignment rate. For example, groups with assignment rates under twenty percent have average fees per claim double those in the 91-99 percent category. This phenomenon is partially attributable to the relative dominance in the low assignment groups of services provided by physician specialties with high average fees per claim. For example, we have found that internists, with higher than average charges per claim, account for 39 percent of assigned claims in Group 1, but for only twenty percent in Group 90.

6.3.2 Assignment Rates and Market Areas

Table 6-7 examines the distribution of assigned charges by market area in the low (0% to 10%) and high (80% to 100%) assignment rate categories. Table 6-8 has these breakdowns for the unassigned component. Two features are prominent. First, Detroit and Pontiac combined represent 55 percent of all assigned charges and, with the contiguous Warren and Flint markets, account for 71 percent. Second, physicians are more likely to accept assignment in these and other urbanized areas, although Grand Rapids, the third most populated market, is an exception. For example, the ratio of unassigned to assigned charges is 0.18 in Detroit and does not exceed 0.28 in the greater Metropolitan area, including Flint, Pontiac, and Warren. On the other hand, the level of unassigned billings is nearly as great and in two cases greater than assigned charges in the smaller and more rural markets, including Petoskey, Traverse City, Marquette, Muskegon and St. Joseph. Unassigned charges also exceed assigned charges in Grand Rapids, the one significant exception to this pattern.

Table 6-7

TOTAL ASSIGNED MEDICARE CLAIMS, CHARGES, PAYMENTS, AVERAGES PER CLAIM

AND HIGH AND LOW ASSIGNMENT LEVEL PERCENTAGES BY MICHIGAN MARKET AREA, 1980

Market Area	# of Physicians	# of Claims	Total Charges	Avg. Chg. Per Claim	Total Payments	Avg. Paymt. Per Claim	-------% Group 0-10--------			------% Group 80-100-------		
							Claims	Charges	Payments	Claims	Charges	Payments
1. (Bay City)	288	77,392	$ 2,618,658	$33.84	$ 2,043,377	$26.40	1.9%	2.8%	2.8%	60.5%	46.4%	46.8%
2. (Petoskey)	279	47,916	1,643,137	34.29	1,290,393	26.93	20.4	28.5	29.0	32.6	24.2	24.1
3. (Flint)	1,089	259,742	9,387,556	36.14	7,440,691	28.65	1.5	2.9	2.9	66.6	57.1	57.5
4. (Traverse City)	377	59,278	1,943,278	32.78	1,535,899	25.91	5.8	8.3	8.3	41.5	35.5	36.4
5. (Lansing)	827	104,864	3,632,378	34.64	2,861,032	27.28	3.4	4.7	4.7	69.3	60.7	60.9
6. (Kalamazoo)	823	133,320	5,545,552	41.60	4,430,745	33.23	6.9	8.2	8.1	57.6	50.1	51.2
7. (Grand Rapids)	1,287	174,585	6,239,505	35.74	4,952,318	28.37	7.2	10.0	9.9	51.1	46.9	47.8
8. (Warren)	1,315	289,870	12,547,104	43.29	9,865,253	34.03	3.2	5.2	5.2	61.2	52.5	52.5
9. (Marquette)	349	54,785	1,930,116	35.23	1,506,047	27.49	6.3	7.8	7.8	42.5	32.1	31.9
10. (Muskegon)	345	56,946	2,084,073	36.60	1,644,144	28.87	6.9	11.5	11.5	47.7	43.1	43.1
11. (Pontiac)	3,004	662,232	27,872,066	42.09	21,991,583	33.21	2.4	3.9	3.9	69.6	61.6	61.8
12. (Saginaw)	671	142,918	5,333,870	37.32	4,210,211	29.46	2.8	4.5	4.4	56.9	44.5	45.2
13. (Ann Arbor)	1,110	211,324	8,637,541	40.87	6,869,100	32.51	2.5	3.6	3.5	77.1	67.5	68.0
14. (Detroit)	4,881	1,351,222	49,281,534	36.47	39,090,937	28.93	1.3	2.6	2.6	81.8	73.1	73.3
15. (St. Joseph)	232	40,249	1,241,293	30.84	992,483	24.66	4.8	8.5	8.4	53.1	31.2	32.6
State	16,877	3,666,643	$139,937,660	$38.17	$110,724,214	$30.20	2.9%	4.5%	4.5%	70.1%	61.1%	61.4%

Table 6-8

TOTAL UNASSIGNED MEDICARE CLAIMS, CHARGES, PAYMENTS, AVERAGES PER CLAIM, AND HIGH AND LOW ASSIGNMENT LEVEL PERCENTAGES BY MICHIGAN MARKET AREA, 1980

Market Area	# of Physicians	# of Claims	Total Charges	Avg. Chg. Per Claim	Total Payments	Avg. Paymt. Per Claim	-------% Group 0-10--------			------% Group 80-100-------		
							Claims	Charges	Payments	Claims	Charges	Payments
1. (Bay City)	288	48,272	$ 1,150,131	$23.82	$ 896,596	$18.57	45.3%	50.6%	50.5%	3.7%	4.4%	4.4%
2. (Petoskey)	279	71,005	2,117,773	29.82	1,663,837	23.43	66.7	73.5	73.8	0.5	0.5	0.5
3. (Flint)	1,089	128,450	2,400,326	18.68	1,870,700	14.56	38.5	42.3	42.1	5.3	5.8	5.8
4. (Traverse City)	377	65,041	1,806,842	27.78	1,406,088	21.61	46.6	56.3	56.4	1.4	0.9	0.9
5. (Lansing)	827	70,204	1,914,412	27.26	1,492,048	21.25	50.5	60.4	60.2	3.0	2.2	2.2
6. (Kalamazoo)	823	147,785	3,978,709	26.92	3,103,828	21.00	56.2	59.6	59.6	1.1	1.1	1.2
7. (Grand Rapids)	1,287	210,785	6,753,053	32.03	5,274,240	25.02	54.9	58.8	58.8	1.3	0.9	0.9
8. (Warren)	1,315	184,786	3,931,527	21.27	3,080,421	16.67	40.8	44.5	44.6	4.2	3.7	3.7
9. (Marquette)	349	76,103	2,492,153	32.74	1,949,561	25.61	30.9	31.2	31.2	1.6	0.8	0.8
10. (Muskegon)	345	60,200	2,019,964	33.55	1,575,651	26.16	49.0	55.3	55.3	1.9	1.3	1.3
11. (Pontiac)	3,004	349,742	7,674,649	21.94	5,982,397	17.10	41.4	44.4	44.3	4.4	4.8	4.8
12. (Saginaw)	671	100,708	2,412.649	23.95	1,884,784	18.71	37.1	48.4	48.4	3.1	2.4	2.4
13. (Ann Arbor)	1,110	108,048	2,978,965	27.57	2,310,920	21.38	51.1	55.6	55.4	3.0	2.1	2.1
14. (Detroit)	4,881	467,418	9,080,373	19.42	7,085,719	15.15	44.7	48.0	48.0	5.9	6.5	6.5
15. (St. Joseph)	232	34,718	1,018,029	29.32	791,646	22.80	50.2	49.8	49.8	2.9	1.6	1.6
State	16,877	2,123,265	$51,729,555	$24.36	$40,368,436	$19.01	45.9%	51.1%	51.0%	3.6%	3.9%	3.2%

6.4 Individual Physician Analysis

Blue Cross and Blue Shield of Michigan had been able to recover a limited set of data for 1975-1978 from a 1978 tape prepared by its Health Care Statistics Department for Dr. D. Yett of the University of Southern California. This tape contains Medicare claims data for 56 procedures (see Appendix C). When combined with data from the comprehensive 1979-1980 files that we developed, fee and use indices for the entire 1975-1980 period were produced. Apart from a relatively small and selective set of procedures in the time-series, the 1975-1978 data do not include the physicians' original charges and, as discussed below, the indices for at least one year (1977) appear to be deficient. Consequently, apart from having to work with Medicare reasonable charges, as opposed to the preferred original charge data, the findings from these time-series should be interpreted with caution.

Following the methods described for the Blue Shield physician samples, a compiled tape was created. This tape contains the Medicare claims data for each provider code for 1975-1980 and the corresponding secondary market variables. It has approximately 11,600 observations per year.

As in the Blue Shield approach, a panel group of physician practices was defined. Members of this group had to have remained in the same market for the entire period and provided at least 10 RVUs of Medicare services per year. There are 5,164 annual observations in this core. Because the 56 procedures are dominated by medical care and surgery, only two physician groupings, primary care and general surgery, were examined in detail. With an adequate but not as large sampling as on the Blue Shield side, a five-patient, 25-RVU criterion was selected for inclusion in the analytical work. Low fee cases were eliminated, as were other outliers, in the econometric investigations.

Before we examine the fee and use indices, we comment on some important limitations of the data. The statewide weighted average indices for the nominal and real reasonable charges (NC* and RC*), respectively, and RVUs per unique patient are shown in Table 6-9. It is obvious that fee and use indices for both samples for 1977 are inconsistent with the general trends. In addition, the fee increases of about 24 percent for each group between 1978 and 1979 seem unusually large. One explanation for the discrepancy is the adjustments that we have made for substantial coding errors in aggregating procedures in the 1979-80 claims data. Such adjustments do not appear to have been made in the 1975-78 data. Because we were unable to make similar corrections in the 1977 data, 1977 was dropped from the analysis; hence the dynamic fee-adjustment equation could not be estimated. Furthermore, with the possibility that the 1975-78 data are not totally consistent with the 1979-80 indices, one cannot reach any definitive conclusions from any analysis of the pooled data sets.

Table 6-9

WEIGHTED STATE MEANS FOR
NOMINAL AND REAL REASONABLE
CHARGES AND RVUs PER PATIENT: 1975 - 1980

	Primary Care			General Surgeons		
	NC*	RC*	Q	NC*	RC*	Q
1975	6.91	6.49	4.92	7.79	7.34	8.85
1976	7.69	6.84	5.14	8.51	7.60	8.14
1977	7.88	6.60	4.51	8.42	7.07	5.88
1978	9.00	6.96	6.33	10.13	7.85	8.55
1979	11.11	7.72	7.09	12.58	8.76	9.64
1980	12.02	7.71	7.22	13.37	8.62	9.15

6.4.1 Medicare Primary Care Fees and Utilization

The pattern of primary care fees is predictable (See Table 6-10). Detroit, Pontiac, Warren, Flint, and Ann Arbor have the highest nominal charges; Marquette and St. Joseph have the lowest.[3] In real terms, fees are highly uniform, with all but two markets falling within a $1 range ($7.24-$8.23). Moreover, the intramarket variations are low, lower than those observed for Blue Shield, although it would be expected that reasonable charges would be more uniform than actual charges which are not constrained.

The increase in Medicare fees is considerably greater than that of Blue Shield fees. Real reasonable charges increased by almost 19 percent (12.7 percent since 1976) compared to a 6.5 percent increase in real Blue Shield charges for PCs since 1976.[4] However, the increases for the major areas are in line with the average state increases.

The most important result, and one that conflicts with the corresponding Blue Shield findings, is the large growth in the care rendered per patient. The weighted increase for the state is almost 47 percent compared to a weighted increase of just 2.7 percent for Blue Shield beneficiaries. There is no particular pattern to the market increases with both small and larger markets, notably Pontiac, showing exceptionally large growth. In view of the data limitations discussed above, this growth should be considered a tentative finding, but it would emerge as a significant result were it corroborated by other data.

From the reliable data for 1980, we also can conclude that use rates in the Detroit-Flint corridor are distinctly higher than elsewhere. (Petoskey, with only 22 observations is not a meaningful exception.) In the Blue Shield case, the intensity measure was only slightly higher in these markets than in the rest of the State.

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[3] The low fees for St. Joseph are consistent with the Blue Shield aggregated findings, but not with those obtained from the Blue Shield physician sample shown in Table 5-1. With only 29 observations, that sample is probably an anomaly.

[4] To the extent that there could be a downward bias in the 1975-78 Medicare fee indices, this difference may be overstated.

Table 6-10

MEDICARE FEES AND USE FOR PRIMARY CARE 1980
PERCENT CHANGES 1975 - 1980 AND
COEFFICIENTS OF VARIATION: 1980

Market Area (Major City)	N	NC*	RC*	Q	% Charge 1975-1980 NC*	RC*	Q	Coefficient of Variation NC*(RC*)	Q
Bay City	46	11.10	7.41	5.86	56.6	6.0	54.6	10.4	27.7
Petoskey	22	11.78	7.80	8.68	122.7	54.2	148.0	7.1	18.1
Flint	163	11.98	7.84	7.30	72.6	14.8	56.0	11.1	76.0
Traverse City	42	11.26	7.58	5.69	80.2	27.0	40.4	15.1	28.8
Lansing	81	10.66	6.84	5.57	63.0	7.2	6.5	18.5	54.4
Kalamazoo	108	10.95	7.24	6.03	74.9	19.3	59.1	14.2	27.2
Grand Rapids	147	11.20	7.56	5.82	77.8	23.3	50.4	14.6	38.5
Warren	148	12.89	8.06	7.02	80.3	23.1	45.6	11.6	43.3
Marquette	51	10.14	7.33	5.94	97.7	35.2	65.0	13.8	30.5
Muskegon	59	10.60	7.43	5.99	67.7	15.4	28.9	22.7	59.6
Pontiac	282	13.17	8.23	8.15	77.3	20.9	69.1	10.7	62.2
Saginaw	84	11.49	7.55	7.50	82.8	22.2	66.1	13.4	59.0
Ann Arbor	126	12.03	7.56	6.15	84.8	25.4	26.5	16.6	42.1
Detroit	550	12.22	7.64	7.70	70.2	16.1	33.9	21.3	53.8
St. Joseph	18	9.53	6.32	6.59	69.1	16.4	55.4	8.8	26.0
Weighted Mean	1927	12.02	7.71	7.22	74.0	18.8	46.7	16.7	54.8
Unweighted Mean	1927	11.97	7.69	5.91	72.7	21.3	45.6	15.3	54.0

NOTE: Charges represent Medicare reasonable charges. The market area values are weighted (by RVUs) averages. The primary care specialties include general practice, family practice, internal medicine, and pediatrics. The coefficients of variation for nominal and real charges per RVU are identical for their respective market areas -- the values for real charges are given for the State means.

6.4.2 Medicare General Surgery Fees and Utilization

As seen in Table 6-11, general surgeons' nominal reasonable charges were 11.2 percent higher than primary care provider fees--a figure close to the 11.8 percent difference in nominal charges in the corresponding Blue Shield samples. Many of the fee patterns discussed previously for PCs are found here. Real reasonable charges are relatively uniform across markets, and intramarket variations are relatively low and similar to those above as well. Significantly, the growth in real charges is consistent with those of PCs, but inconsistent with the growth of 4.3 percent since 1976 in the Blue Shield sample.

As for use, aside from Warren, Muskegon, and Pontiac, service intensity tends to cluster around 8 RVUs per unique patient. There is no obvious explanation for the twelve-plus values in both Warren and Pontiac. In addition, these two markets show relatively large increases in Q since 1976, as opposed to negative changes found in five cases and relatively small increases, e.g., less than 10 percent in four others. Because of these relatively low or negative growth rates, the overall weighted state increase in surgical intensity per patient was only 3.4 percent since 1975. This figure, which is very close to the 2.5 percent increase in the Blue Shield sample of general surgeons, lends some credibility to the 1975-78 component of the Medicare data base.

Table 6-11

MEDICARE FEES AND USE FOR GENERAL SURGEONS: 1980
PERCENT CHANGES 1975 - 1980 AND
COEFFICIENTS OF VARIATION: 1980

Market Area (Major City)	N	NC*	RC*	Q	% Charge 1975-1980 NC*	RC*	Q	Coefficient of Variation NC*(RC*)	Q
Bay City	13	12.86	8.59	8.05	85.6	25.8	9.1	12.1	30.3
Petoskey	9	12.25	8.12	7.72	92.6	33.3	-10.2	8.6	27.5
Flint	38	11.76	7.70	8.62	46.5	-2.5	-2.5	23.9	52.3
Traverse City	13	10.69	7.19	8.12	59.3	12.2	31.8	10.1	39.9
Lansing	12	12.02	7.71	9.68	58.8	4.9	5.4	14.1	48.1
Kalamazoo	42	13.04	8.62	8.26	69.1	15.2	3.0	14.4	39.5
Grand Rapids	64	12.97	8.76	9.50	66.9	17.2	-32.4	13.0	68.9
Warren	49	13.50	8.44	12.80	67.3	14.0	38.5	13.2	86.4
Marquette	18	11.74	8.49	7.11	105.6	40.6	81.4	11.3	40.2
Muskegon	9	15.09	10.58	10.60	71.3	17.8	30.5	10.2	29.0
Pontiac	69	14.76	9.23	12.62	76.6	20.5	18.8	14.9	67.9
Saginaw	19	12.45	8.18	8.66	58.8	6.8	-13.9	12.8	46.5
Ann Arbor	43	12.64	7.94	8.08	75.0	10.0	-14.9	12.6	43.5
Detroit	157	14.48	9.05	7.78	81.9	24.0	3.5	13.9	41.0
St. Joseph	9	12.26	8.13	8.33	67.9	16.1	37.1	9.4	36.4
Weighted Mean	564	13.37	8.62	9.15	71.6	17.4	3.4	15.7	63.7
Unweighted Mean	564	13.65	8.08	8.08	72.1	17.2	13.2	16.5	54.9

NOTE: Charges represent Medicare Reasonable Charges. The market area values are weighted (by RVUs) averages. The coefficients of variation for nominal and real charges per RVU are identical for their respective market areas -- the values for real charges are given for the State means.

6.5 Econometric Results

Descriptive measures and simple correlation coefficients for selected variables are found in Tables 6-12 and 6-13 respectively. Table 6-12 shows that, despite the relatively small number of procedures as compared to the Blue Shield samples, the data are comprehensive. The mean nominal Medicare charges per physician are $11,000 and almost $9,000, respectively. Table 6-12 indicates also the effects of adjusting actual availability ratios for bordercrossing between markets. There are sometimes substantial differences between the actual and effective MD/POP ratios, e.g., for primary care, as indicated by both the respective means and ranges. We expect that the effective ratios are better indicators of physician availability for the Medicare population, although econometric models have been estimated both ways.

The simple correlation coefficients in Table 6-13 are revealing. Unlike the Blue Shield samples, there are relatively stronger correlations between the fee measures and physician availability and, for general surgeons, between Q and the actual general-surgeon and bed-population ratios. Interestingly, the effective population measures have dramatic effects on the correlation coefficients. For example, the coefficients between both NC* and RC* and PC/POP for the primary care sample are negative and relatively high while these same variables have relatively strong positive coefficients with PC/EPOP.

As with the Blue Shield data, there are a number of relatively high correlation coefficients--especially with fees. Real per capita income, urbanization, the Blue Shield penetration rate, and the percent of Medicare population with complementary coverage, are positively correlated with fees, and to some extent also with use. Interestingly, the percent of population covered by Medicare is negatively correlated with nominal charges and service intensity in both samples. This reflects the disproportionate number of elderly living in less expensive rural areas.

Table 6-12

MEANS, STANDARD DEVIATIONS, MINIMUM
AND MAXIMUM VALUES FOR SELECTED VARIABLES: 1980

	Primary Care (N=1902)				General Surgeons (N=559)			
VARIABLE	MEAN	STD. DEV.	MIN.	MAX.	MEAN	STD. DEV.	MIN.	MAX.
TNC*	11008	23063	256	878551	8755	8674	222	123191
RVU	902	1890	26	72978	661	662	26	9796
PAT	152	259	5	7836	92	122	5	1680
Q	5.90	3.04	0.49	42.09	8.10	4.44	0.74	38.35
NC*	11.94	1.86	6.35	16.33	13.63	2.29	7.56	19.97
RC*	7.67	1.11	4.39	10.21	8.78	1.40	4.95	12.49
NP	9.25	1.47	4.63	13.00	10.65	1.85	5.96	15.93
RP	5.94	0.87	3.35	8.13	6.86	1.13	3.90	9.96
MD/POP	13.79	4.09	8.53	22.77	13.38	3.87	8.53	22.77
MD/EPOP	13.23	2.52	9.26	1.90	12.99	2.55	9.26	18.98
PC/POP	3.07	0.43	2.36	4.22	3.08	0.43	2.36	4.22
PC/EPOP	5.03	1.23	3.44	9.19	4.92	1.30	3.44	9.19
GS/POP	1.92	0.28	0.78	1.86	1.29	0.25	0.78	1.86
GS/EPOP	1.38	0.55	0.86	2.63	1.36	0.51	0.86	2.63
OMD/POP	10.72	4.33	4.99	20.41	10.30	4.07	0.50	20.40
OMD/EPOP	8.20	1.76	4.92	11.43	8.07	1.67	4.92	11.43
BED/POP	4.65	0.99	2.60	7.51	4.67	1.01	2.60	7.51
BED/EPOP	4.74	0.85	2.48	6.89	4.72	0.90	2.48	6.89

NOTE: Definitions of the variables are found in Table 5-9, Chapter 5. The * indicates Medicare Reasonable charges.

Table 6-13

SIMPLE CORRELATION COEFFICIENTS BETWEEN NOMINAL AND REAL REASONABLE CHARGES PER RVU, RVUs PER PATIENT, AND SELECTED VARIABLES: 1980

	Primary Care (N=1902)			General Surgeons (N=559)		
	NC*	RC*	Q	NC*	RC*	Q
NC*	1.00			1.00		
RC*	0.97	1.00		0.97	1.00	
Q	-0.01	-0.04	1.00	0.15	0.16	1.00
MD/POP	0.27	0.18	0.07	0.29	0.19	0.08
MD/EPOP	0.32	0.21	0.11	0.29	0.17	-0.02
PC/POP	-0.17	-0.13	-0.02	-0.17	-0.14	-0.08
PC/EPOP	0.17	0.10	0.08	0.12	0.03	-0.05
GS/POP	0.25	0.17	0.06	0.21	0.14	0.18
GS/EPOP	0.21	0.14	0.03	0.21	0.15	0.08
BED/POP	-0.02	-0.01	0.04	-0.03	-0.03	0.10
BED/EPOP	0.04	0.03	0.02	0.03	0.02	-0.00
Y	0.38	0.23	0.10	0.39	0.25	0.09
URB	0.41	0.25	0.14	0.43	0.28	-0.00
ED	0.08	0.03	-0.03	0.02	-0.02	0.10
BCBSM	0.40	0.24	0.12	0.32	0.15	0.05
MED	-0.23	0.10	-0.04	-0.17	-0.03	-0.08
COMP	0.38	0.23	0.11	0.28	0.18	0.04

The regressions are shown in Table 6-14. As noted above, because of the gap in the time-series, we are unable to estimate the dynamic fee adjustment model. Only the "Reinhardt Test" of inducement and utilization tests under the assumption of fee rigidities are attempted. In addition, as a result of possible problems with the pre-1979 data, each equation is estimated on the 1979-80 data alone (shown by equations with a prime). As a further precaution against errors in measurement, each equation was estimated with actual as well as effective availability ratios. Only the coefficients of the actual availability variables from those regressions, however, are shown at the bottom of Table 6-14.

The models are very similar to those estimated for Blue Shield beneficiaries. However, because we are dealing solely with the Medicare population, a few changes were made. The percent of Medicare recipients (MEDICARE); the percent with complimentary coverage (COMP), and the present equal or greater than 65 years old (OV65), were introduced, replacing previous age and Blue Shield variables.

6.4.1 Primary Care

Results of the "Reinhardt Test", using all the available data (1) and the more reliable 1979-80 data (1'), are shown in Table 6-14. Both equations have relatively high R^2s. The findings with the effective physician availability ratios are also consistent with the Blue Shield estimates, which indicate a positive availability effect of primary care providers on their fee levels. The availability of other physicians (OMD/EPOP) has no effect.

Other variables with consistent significant results in equations (1) and (1') are the positive effects of real wages, the work-loss rate and specialty dummies; and the negative effect of education and percent with complementary coverage. There is some weaker evidence, over all four estimates, that the availability of beds has a positive impact on real fees.

The R^2s for the use regressions are much lower than in the fee equations particularly for (2'). The results, possibly because of the poor fit and the problems of our intensity measure (discussed in Chapter 5), do not support the inducement hypothesis. There is some weak evidence across all four use regressions, more pronounced with the actual rather than the effective measure, of a negative relationship between intensity and the availability of primary care physicians, and a direct effect, stronger in the effective regressions, of the availability of other physicians. Moreover, there is weak evidence with the effective measures of a negative impact of bed availability. Other generally consistent findings are positive effects of age (OV65) and the specialty dummies, though D-IM has a negative sign in (2'), and negative effects of fees and the work-loss rate (LORT).

Table 6-14

MEDICARE FEE AND UTILIZATION REGRESSIONS

Dep. Var/ Ind. Var	Primary Care (1) RC*	(1') RC*	(2) Q	(2') Q	General Surgeons (3) RC*	(3') RC*	(4) Q	(4') Q
CONST	1.882	4.064	-5.339	-8.590	0.072	-0.662	-0.061	7.963
	(2.48)	(2.96)	(-2.07)	(-1.66)	(0.03)	(-0.17)	(-0.01)	(-0.65)
RC*			0.465	0.330			1.058	0.796
			(-13.12)	(-5.60)			(19.96)	(8.16)
Y	0.029	0.105	0.186	0.204	0.205	0.570	0.444	-0.053
	(0.83)	(1.70)	(1.58)	(C.88)	(2.22)	(3.49)	(1.66)	(0.10)
ED	-0.377	-1.574	-1.307	-2.124	0.475	-0.267	-2.46	3.754
	(-1.61)	(-2.99)	(-1.64)	(-1.07)	(0.72)	(-0.205)	(-1.29)	(0.90)
URB	0.020	-0.034	-0.017	-0.120	0.176	0.110	-0.228	0.138
	(1.45)	(-1.21)	(-0.36)	(-1.13)	(4.53)	(1.52)	(-2.02)	(0.59)
FEM	-0.295	0.301	-0.629	-1.492	-0.804	0.726	-2.874	-9.425
	(-1.42)	(0.62)	(-0.89)	(-0.82)	(-1.39)	(0.70)	(-1.70)	(-2.84)
MINOR	-0.047	0.015	0.032	0.062	0.069	-0.119	0.097	-0.108
	(-6.08)	(0.94)	(1.24)	(1.01)	(-3.22)	(-0.25)	(1.56)	(-0.71)
MEDICARE	-0.014	-0.081	0.101	0.264	0.071	0.210	-0.546	0.157
	(-0.36)	(-1.35)	(0.76)	(1.17)	(0.70)	(1.29)	(-1.85)	(0.30)
COMP	-0.038	-0.106	0.035	-0.018	-0.023	-0.006	-0.112	0.060
	(-2.34)	(-2.94)	(0.64)	(-0.14)	(-0.51)	(-0.06)	(-0.09)	(0.21)
OV65	-0.387	-0.048	1.654	2.314	-0.543	(-0.576)	2.344	-0.377
	(-2.46)	(-0.177)	(3.08)	(2.24)	(-1.16)	(-0.70)	(1.73)	(-0.14)
MEDICAID	0.23	-0.125	-0.005	-0.111	0.166	0.005	-0.015	0.388
	(1.21)	(-2.39)	(-0.07)	(-0.56)	(3.33)	(0.03)	(-0.10)	(0.86)
PC/EPOP	0.030	0.108	-0.080	-0.114	-0.137	-0.194	-0.048	-0.226
	(1.54)	(2.72)	(-1.21)	(-0.76)	(-4.05)	(-2.65)	(-0.48)	(-0.96)
OMO/EPOP	0.018	0.015	0.187	0.245				
	(0.81)	(0.37)	(2.44)	(1.57)				
GS/EPOP					-0.006	-0.172	0.127	-0.082
					(0.12)	(-2.03)	(0.92)	(-0.30)
BED/EPOP	0.082	0.004	-0.085	-0.097	0.141	0.241	-0.251	0.205
	(6.64)	(0.20)	(-2.01)	(-1.71)	(3.92)	(3.91)	(-2.39)	(1.03)
W	0.437	0.311	0.134	0.409	0.092	-0.044	-1.505	-1.144
	(9.27)	(2.97)	(0.83)	(1.03)	(0.73)	(-0.19)	(-4.13)	(-1.50)
DRT	-0.004	-0.015	-0.054	-0.073	-0.018	-0.070	-0.000	-0.010
	(-0.72)	(-1.51)	(-2.92)	(-1.89)	(-0.97)	(-2.46)	(-0.17)	(-0.11)
LORT	0.066	0.054	0.033	-0.009	0.155	0.237	-0.002	0.288
	(6.77)	(3.36)	(0.99)	(-0.15)	(5.05)	(4.68)	(-0.33)	(1.75)
D-FP	0.073	0.125	0.085	-0.021				
	(21.50)	(24.92)	(7.12)	(-1.02)				
D-IM	0.187	0.187	0.030	0.040				
	(65.84)	(46.37)	(2.56)	(2.11)				
D-FED	0.093	0.111	0.185	0.380				
	(6.43)	(5.87)	(3.75)	(5.33)				
D-76	0.035		0.095		0.029		0.005	
	(7.14)		(5.72)		(2.50)		(0.14)	
D-78	0.074		0.311		0.080		0.150	
	(9.76)		(12.04)		(3.75)		(2.42)	
D-79	0.177		0.390		0.151		0.122	
	(25.23)		(15.82)		(7.07)		(1.94)	
D-80	0.217	0.009	0.416	0.020	0.208	0.043	0.063	0.087
	(24.05)	(1.06)	(13.12)	(0.63)	(7.29)	(1.87)	(0.75)	(1.17)
R^2	0.506	0.418	0.153	0.050	0.179	0.130	0.173	0.092
N	9261	4100	9261	4100	3029	1105	3029	1105
PC/POP	0.020	0.062	-0.188	-0.481	-0.201	-0.052	0.351	0.601
	(0.65)	(0.85)	(-1.77)	(-1.75)	(-2.33)	(-0.20)	(1.40)	(0.70)
OMO/POP	0.056	0.036	0.030	0.179				
	(4.48)	(1.26)	(0.70)	(1.67)				
GS/POP					-0.174	-0.290	0.172	-0.131
					(-3.90)	(-2.94)	(1.40)	(-0.41)
BED/POP	0.054	0.045	-0.002	-0.114	0.111	0.118	-0.446	-0.137
	(2.88)	(1.49)	(-0.03)	(-1.00)	(2.07)	(1.32)	(-2.85)	(-0.48)

NOTE: Regressions numbered with primes (') are based on 1979-80 data; the others on 1975, 76, 78-80 data. The coefficients of actual availability variables when substituted for the effective ratios are shown below the corresponding regressions.

6.4.2 General Surgeons

As expected from the simple correlation coefficients, the R^2s in the GS fee regressions (3) and (3') in Table 6-14 are not as high as those for PCs. However, like the GS regressions, the effective population adjustments have a strong impact on the findings. For example, the actual general surgeon-population ratio has a significant negative effect on real fees in the equivalent to both (3) and (3') not found with the effective estimates. There is, however, some degree of consistency to indicate that an increase in the availability of primary care physicians reduces general surgeons' fees. In any event, the "Reinhardt Test" is not supported, and, if anything, there is weak evidence of competitive effects.

Other variables that are consistently significant are: real income (Y); the work-loss rate (LORT); and, to a lesser extent, the bed-population ratio (BED/POP or BED/EPOP). Each has a positive impact on real fees.

There is no evidence of any availability effects on service intensity. With the exception of real charges, which enter with an incorrect sign, there are no consistently significant results across the use equations.

6.4.3 Conclusions

Despite some serious data limitations, the Medicare micro-physician analysis supports conclusions from the Blue Shield regressions, verifying the "Reinhardt Test" for primary care providers, but fails to do so for general surgeons where, *a priori*, inducement is thought to be more prevalent.

Both sets of findings suggest also that use regressions with an intensity measure are unlikely to be productive in an individual physician model. The disequilibrium model that we have proposed may be appropriate only for an aggregated approach using per capita measures of utilization, unless a more suitable measure of physician output can be developed. The total output of each physician, which, other things being equal, would be expected to decrease in proportion to increases in physician availability, is preferable to our intensity measure. It would, however, require data on each physician's entire practice--data that we do not have.

Chapter 7

AN ANALYSIS OF PHYSICIAN SERVICES' UTILIZATION AND COSTS USING DIAGNOSTIC TRACERS

Introduction

In this chapter we will study the issue of physician inducement using a diagnostic tracer methodology. This methodology may provide answers to the following research question:

- o Does service utilization vary for patients with identical diagnoses and if so, how?

We know *a priori* that all medical diagnoses cannot be treated by physicians in the same way, and patients with different illnesses will vary in terms of service utilization. Of particular interest, however, is the nature of such variation among patients with *identical* diagnoses: Which types of services are most frequently used by patients with the same illness, and does service intensity vary systematically with physician-population ratios? Multivariate analyses of major patient subsets will provide estimates of the variation in service utilization which can be explained by physician and/or patient characteristics.

7.1 Review of the Tracer Method

7.1.1 Background of the Tracer Method

Historically, the tracer methodology has been used almost exclusively to evaluate quality of care. Although the issue of concern to the proposed study is primarily one of cost, there are nonetheless some quality concerns inherent in physician-induced demand since inducement can be viewed as "unnecessary" medical care. More importantly however, a review of the past research which has relied on the tracer method -- albeit quality oriented -- sheds light on general methodological and research design issues regarding this technique.

In their simplest definition, tracer diagnoses are specific health conditions that, individually or combined in sets, allow systematic examination of the interaction between providers, patients and the medical care environment. The tracer method most commonly involves an assessment of the processes that comprise what is generally known as the "practice of medicine," using a particular diagnosis or set of diagnoses as a standardized unit(s) of observation. The actual care processes used to treat a specific diagnosis (the tracer) are then compared to implicitly or explicitly agreed upon standards and criteria which define the medically "correct" or optimal treatment of that diagnosis. The rationale underlying the method is that if "proper" actions are taken in treating patient conditions, final health status outcome will be the best attainable (see Christoffel and Lowenthal, 1977).

The tracer concept was borrowed from the pure sciences and is not new as a method for analyzing health services delivery. As early as 1950, Ciocco et al. (1958) analyzed the services provided to 3200 ambulatory care patients utilizing case records as a source of data, and divided diagnoses into 18 categories to evaluate variations in treatment for similar diagnoses. Their study concluded that, after correcting for age, sex and diagnosis, variations in the amount and type of patient care provided could be explained by physician training and specialty status. Morehead et al. (1970) reviewed charts based on implicit judgment to evaluate the performance of neighborhood health centers using the performance of medical-school affiliated outpatient departments as a standard of comparison.

These studies utilized specific health problems or morbidity conditions as indicators of treatment processes; however, the tracer method marked the inception of a highly structured approach to the use of specific diagnoses in evaluating the behavior of medical care providers. As used by the National Institute of Medicine (then called the Board of Medicine) in 1969, the tracer method became more sophisticated and included criteria for care specifications, and concurrent assessment of physicians, the community and the patient in the care process.

Much of the credit for developing the tracer method as it is now used is generally given to Kessner et al. (1973) who illustrated how

tracer conditions could be used to study service provision. Six diagnostic "tracer" conditions were used: middle ear infection; visual disorders; iron-deficiency anemia; hypertension; urinary tract infection; and cervical cancer. Kessner's study sets forth criteria for selecting tracer diagnoses for evaluative studies; clinical aspects of treating his six selected tracers (which could serve as explicit criteria in assessing the treatment process); and presents an example of the method's application. As he points out, the tracer method can be applied to a variety of organizations that provide care to a given population, including evaluation of individual physicians.

7.1.2 Literature Review

The tracer method used by Kessner _et al_. (1973) examined care in a hypothetical ambulatory health care setting. Subsequent studies, however, have relied heavily on hospital-based services. Two notable exceptions are a study by Kane _et al_. (1977) of over 400 episodes of acute care in two family practice centers, and LoGerfo's (1978) study of urinary tract infections in prepaid group practices (PGPs) and independent practice settings (IPPs). LoGerfo chose urinary tract infection (UTI) for study based on his perception that the diagnosis is illustrative of "typical" clinical and organizational behavior because it is commonly seen in ambulatory care settings. His empirical results indicate "questionably appropriate" use of laboratory services (cultures) in the PGPs. These settings had laboratory utilization indices (PLIs) that were almost twice those of the IPP settings. By comparison, greater uniformity of antibiotic prescription in treating urinary tract infection, and higher indices for history taking and examination criteria were found in the PGPs. In previous work, LoGerfo notes similar differences in findings for the treatment of common infections as well as hypertension (LoGerfo, 1977). He speculates that the ease with which lab tests can be performed, and results retrieved may account for the greater use of such services in PGPs. Overall, LoGerfo concludes that the tracer is an effective way of demonstrating apparently strong relationships between the organizational context of practice and the quality of care provided. Because the study made no attempt to relate patient outcomes to services rendered, however, no conclusions could be drawn as to whether patients did "better" as a result of more laboratory tests and/or better recordkeeping.

Using a sample of physicians in Fort Wayne, Indiana, Romm and Hulka (1979) observed process versus outcome measures for the following tracer conditions: pregnancy, healthy children in the first year of life, and diabetes mellitus. However, no significant relationship between process and outcome was shown. Starfield and Scheff (1972) have shown that at least one specific clinical aspect of care process, treatment with iron, was positively associated with the treatment of the tracer condition pediatric anemia. Kane _et al_. (1977) obtained results indicating a positive relationship between the process scores on explicit criteria developed by a local PSRO for seven tracer conditions -- otitis media, hypertension, bronchitis, pharyngitis, tonsillitis, urinary tract infection

and vaginitis -- and outcomes of care, as measured by the degree to which the patient regained usual functional status.

The questionable existence of a direct relationship between patient care processes and health status outcome is one of major concern since it is difficult to be critical of care processes -- e.g., more or less "doctoring" -- as a quality concern in the absence of empirical proof that process does affect health outcome. Nonetheless, many studies have either failed to consider process and treatment outcome simultaneously, or are unable to show statistically significant evidence in support of a relationship between the two. This is a major limitation of many tracer studies of medical care processes and confounds the meaningfulness of their results.

7.1.3 The Impact of Physician Supply on Tracer Diagnoses

As this brief review of past research indicates, most studies using the tracer method have used it in its truest sense -- to observe quality of care; however, a number of researchers (see e.g., Reinhardt, 1978) have suggested that tracers could be used to examine other aspects of provider behavior and a few researchers have adapted the method for non-quality of care studies. Of particular relevance to this project is a study by Held and Manheim (1980) of the effects of local physician supply on the treatment of hypertension in Quebec. The Province of Quebec has had a universal health insurance plan since 1971 which reimburses nearly all of the costs of physician services, so that residents pay no major out-of-pocket costs for care. The analysis focused primarily on three measures: total costs, number of office visits, and number of services or procedures (these latter terms are used interchangeably in the study, and refer to services which are reimbursed according to the fixed-fee-schedule of the Quebec Health Insurance Board). The dependent measures are observed on a patient year basis both aggregately and disaggregated by beneficiary age, sex, urban/suburban/metropolitan location, family income and sample year.

With respect to the effects of locational variables such as local GP and specialist-to-population ratios, Held and Manheim observe that treatment costs increase as number of GPs rise and decrease as number of specialists increases. These effects are small, however. Increases in the number of specialists relative to population are associated with lower revisit rates. Held and Manheim conclude that treatment of hypertension is not independent of local physician supply.

Of particular concern for our inducement study is the fact that the Held and Manheim study cannot determine in its econometric analysis whether the observed positive relationship between local physician supply and utilization rates is due to non-price rationing or inducement. As the researchers point out, a positive relationship could indicate either. Perhaps by omitting severely underserved areas from the analysis --

areas where non-price rationing is a more likely explanation than in physician rich areas -- a more definitive statement could have been made.

A second problem facing the Held and Manheim study concerns the significance of patient health status as a determinant of utilization. In their claims data, the Health Insurance Board apparently records only one diagnosis, even if the physician indicates more than one. Hence, complicating conditions (such as hypertension accompanied by diabetes mellitus) which could cause more need for treatment, could not be readily identified from the original data base. This is problematic from an analytical standpoint because higher utilization can be erroneously ascribed to the physician (inducement) instead of to the patient's condition. Also, the arbitrary elimination of secondary diagnoses may create possibilities for over or underestimation of visits for hypertension. For example, if numerous visits were given a diagnosis in the claim records other than hypertension, one would observe a below average utilization for hypertension and ascribe behavior to the incorrect diagnosis. (In a regression, this can be controlled for with a negative coefficient sign, indicating that the other diagnosis did not lead to less utilization for hypertension but was obscuring the hypertensive visit.)

7.1.4 Advantages of Tracers

In conclusion, it should be noted that although the focus on quality measurement in past research using the tracer method may not suggest an obvious and immediate application of the method to studies of economic models of physician behavior, the method does have a contribution to make to this body of research. First, tracers allow systematic observation of physician behavior holding critical variables such as illness type or severity constant. This is important because strong statements in support of induced demand can only be made with confidence if variations in observed care processes are not the result of illness type. Secondly, as Sloan (1980) has observed vis-a-vis studies of price differentiation, most studies of provider behavior do not consider inter-practice variations in quality amenities. The assumption that output is homogeneous is too strong. Price differences -- and also variations in utilization rates -- may be due to variations in physician follow-up procedures, length of visit in general, diagnostic rigor, etc. The tracer method, by allowing a means of examining variations in care process for a given diagnosis, can help distinguish between quality amenities that may or may not affect health status. And finally, the tracer method provides a means for examining how physicians make discretionary judgments, especially in the face of extreme latitude concerning appropriate treatment regimen. This issue may have implications not only for the inducement and target income hypotheses, but also for standards of medical education and training, decision making, and peer review.

7.2 Conceptual Framework

7.2.1 Two Research Questions

We begin the study with two major concerns: Where physicians are plentiful, do we observe patients utilizing physician services at higher rates than patients in areas of the state where physicians are relatively scarce? And also, if physicians are more numerous relative to population, are there more physician revisits, laboratory tests, etc., per episode of illness for patients with identical diagnoses?

7.2.2 Conceptual Approach

Sloan and Feldman (1978) and Reinhardt (1978) have commented on the potential for physician control over demand for medical care in their role as patient agents, and these researchers conclude that a physician could induce demand for their services by encouraging patients to use more treatment procedures, laboratory tests, regular office revisits, etc. The inducement theory therefore strongly suggests that an observed positive relationship between physician supply and measure of utilization may be the result of physicians generating more demand for their services per patient to compensate for the relatively lower demand per physician. We fully recognize that there may be other reasons for observing a positive relationship between local physician supply and utilization measures. For example, in areas with large populations covered by private insurance, Medicare or Medicaid, this may be due to non-price rationing. Since no money prices are being paid by consumers, it is possible -- especially in physician shortage areas -- that excess demand exists, and physicians may be rationing their time by having patients use services less frequently.

To test our research questions, we begin with a model that assumes utilization per patient depends on severity, economic demand, area practice costs, and physician supply:

(1) $$U_i = f\,(SEV_{ij};\ D_k;\ S_k;\ MDPOP_k)$$

where U_i = utilization for the ith patient;

SEV_{ij} = severity of illness for the ith patient with the jth illness (diagnosis)

D_k = economic demand for physician services in the kth area

S_k = physician supply costs in the kth substate area;

$MDPOP_k$ = physician/population ratio in the kth area.

Variations in observed utilization rates are then explained as variations in each of these factors.

As the focus of our study is the relationship between utilization and physician supply, we are interested in holding other factors like severity and demand constant that may explain variation in utilization. The utility of the tracer method for our analysis is that it enables us to assume minimal difference in the demand for care based on diagnosis, etc. Clearly, we have a confounding problem if the other variables in our equation are inter-correlated; however, by carefully selecting a very large sample for study, we avoid this problem to some extent. Additionally, careful attention to the resolution of key methodological issues in the use of tracer diagnoses, as well as informed selection of the tracer conditions, should ensure the validity and reliability of our final observations.

As should be apparent, we will not use the tracer method in its purest form in this analysis. Rather, we have drawn upon the "best" elements of the methodology that have relevance for the study at hand and attempted in every way to integrate "tracer" study needs with the goals and methodological requirements of this study in such a way that an optimal design was produced.

7.3 Selection of Three Tracer Diagnoses

7.3.1 Selection Criteria

An important aspect of any evaluation using tracers is the process by which the tracer diagnoses are selected. Tracers must be discrete, identifiable health problems, and the ultimate utility of the evaluation method is fundamentally dependent on the specific tracers used for study. Kessner *et al*. (1973) offers the following criteria for selecting tracer conditions:

- *significant functional impact* -- conditions that are not treatable and those which cause negligible functional impairment are not useful as tracers. The purpose of a tracer diagnosis is to focus on processes of care that reflect the professional activities, behavior and decision-making of health care providers. To the extent that physicians make *a priori* decisions not to aggressively treat terminal, non-responsive or non-impairing diagnoses, an accurate determination of their "normative" treatment behavior is not possible. Selection of a tracer to which physicians respond only palliatively may yield a gross underestimate of resource utilization.

- *well defined and easy to diagnose* -- tracers should be clear cut pathologic entities that are relatively easy to identify in the study population.

- *high prevalence rates* -- tracers should be readily observable in the population. If an adequate number of cases cannot be studied, it is difficult to assess even the most important variables in relation to a set of tracer conditions.

- *the techniques of medical management for the tracer should be well defined* -- for at least one of the following processes -- prevention, diagnosis, treatment or rehabilitation -- the technique for effective medical intervention should be specified using explicit criteria.

- *non-medical effects should be understood* -- the epidemiology of a tracer should be well understood since socio-cultural, economic and behavioral factors can influence the distribution of many morbidity conditions.

To the above criteria set forth by Kessner, two were added to meet some needs specific to this study:

- *latitude in physician management* -- if we can make *a priori* predictions as to the services most conducive to demand shifting, then a sharper test of the inducement hypothesis is possible. We therefore need to know the extent to which elective vs. non-elective procedures can be used to treat a given diagnosis.

- population affected -- to avoid study bias, we wanted some indication of the extent to which certain diseases are more heavily associated with any age, sex or racial/ethnic group.

The "latitude" criterion marks a unique divergence in the needs of an inducement study of this type (a cost analysis) versus a quality study of the type so heavily emphasized in previous research using tracers. Many diagnoses that are not satisfactory for a quality study could, in theory, be excellent choices for a cost study. In the case of a quality study, it is hoped that some measures of uniformity in care processes can be established; therefore, these studies seek to minimize latitude in physician judgment. By contrast, the study at hand is aided by a tracer condition for which a minimum level of care is required, but more intensive treatment is justifiable. Physicians may treat terminal conditions only palliatively; however it may be the case that physicians actively induce demand by patients who will neither be helped nor hurt by "overdoctoring." We chose at least one tracer for this study, urinary tract infection (UTI), that is only minimally responsive to highly intensive medical care in order to observe the range of treatment approaches.

7.3.2 Description and Management of the Three Tracers

In this section, we present the three selected tracer diagnoses and the related criteria discussed in the previous section.

Essential Benign Hypertension

1. Functional Impact: Can be mild to severe.

2. Diagnosis: Easily made based on a quantitative deviation from "statistically usual" blood pressures.

3. Prevalence: Is the second leading BCBSM diagnosis with 4.5% of billed services. Average charge per service was $10.21; average BCBSM payment was $7.15/service. Of specific diseases of the circulatory system, essential hypertension was the number one disease in terms of utilization frequencies.

4. Impact of Care: Study indicates that treatment reduces both morbidity and mortality (Freis, 1962). Substantial relief can be brought about by treatment.

5. Management Criteria: Have been well defined and documented in the literature. There is general consensus on basic care management.

6. Epidemiology: While not totally understood, has been thoroughly studied with substantial data available on various contributing factors.

7. Latitude: Substantial range of physician discretion in determining an appropriate treatment regimen. It is apparently medically and professionally acceptable to see hypertensive patients anywhere from less than once, to many times during a year.

8. Population Affected: An increase in mean diastolic pressure occurs with age so very young persons usually are not affected. Data on relationship to sex is conflicting although women may be less prone. Many reports link hypertension more strongly to blacks at all ages levels and for both sexes. The second most common principal diagnosis reported as a reason for physician visits by persons aged 65 and over. Thus, this diagnosis would enable us to capture a large number of Medicare-specific observations.

9. General Pros and Cons: Hypertension is one of the foremost national health problems today. Weinstein (1976) argues that effective treatment is available but infrequently applied. The disease is a very popular tracer in the literature and is studied in part because there is great variability in physician management behavior (see e.g. Held and Manheim 1980). Must be careful to control for race effects when using this diagnosis.

10. Explicit Criteria: Criteria for diagnosis and treatment of essential hypertension include the following:

Evaluation

family history and physical exam

blood pressure (supine and upright)

may employ the following laboratory tests (Kessner, et al. 1973):

a) urinalysis
b) hematocrit or hemoglobin
c) blood urea nitrogen
d) serum creatinine
e) electrocardiagram
f) rapid sequence intravenous pyelgram (IVP)

Diagnosis

mild essential = diastolic blood pressure (DBP) of 115 mmHg

moderate essential = DBP of 115-130 mmHg

severe essential = DBP greater than 130 mmHg (Joint Committee on Hypertension, 1977)

Management

a) drug therapy (thiazides perhaps in combination with other drugs)
b) may require hospitalization in severe cases
c) may require referral to specialist if severe
d) re-evaluation: (Joint Committee on Hypertension, 1977)
   - while DBP is being lowered = once/month
   - when DBP is under control = every 2 months to check BP (6 times/year)
   - between full exams and lab work = 6 months (twice/year)
   - Mean # visits/episode = 3.1-3.7 (Engelland, et al. 1979)

Adult Onset Diabetes Mellitus

1. Functional Impact: Can be mild to severe.

2. Diagnosis: Usually easily made but can often be manifested through secondary symptoms or as a secondary condition.

3. Prevalence: This condition is generally studied in adults, as "adult onset" diabetes. BCBSM data indicate that it is the third leading diagnosis, representing 3.7 percent of all diagnoses for which billings were submitted. Average charge per service was $8.28/service; average BCBSM payment was $5.87. Of all the frequently utilized services specific to endocring, nutritional and metabolic diseases, diabetes mellitus (adult onset) was number one, with 277,284 services billed.

4. Impact of Care: Study indicates that blood sugar levels can be controlled by treatment and normal functional status continued with proper medication or diet.

5. Management: Although variable depending on severity, the range of criteria are well studied and documented and general consensus on baseline care exists.

6. Epidemiology: Has been thoroughly studied. Varies with dietary, socioeconomic and other factors but general etiology of the disease is known.

7. Latitude: Some range of physician discretion. A baseline, non-elective treatment regimen can be specified but physicians have subsequent flexibility in treating patients.

8. Population Affected: As stated, generally adult-onset diabetes is the more popularly studied form; therefore, young through aged adults would be observed. Also, DHHS data (1978) indicate that diabetes mellitus was the fifth leading cause of ambulatory visits for persons aged 65 and over. Like hypertension then, diabetes is a diagnosis which will capture a

large number of Medicare observations.

9. General Pros and Cons: Diabetes mellitus is also a prevalent disease with extensive policy implications because of management issues. It is popularly studied because of its prevalence and range of treatment alternatives. Also, the disease can be a secondary condition or promote its own secondary conditions (e.g. visual disorders). Care will need to be taken in the analysis to ensure that the compounding effects of diabetes are not misinterpreted as utilization by an individual for many unrelated diseases.

10. Explicit Criteria: Criteria for diagnoses and treatment or diabetus mellitus include the following.

Evaluation

family history and physical exam

laboratory tests:

a) urine glycose test
b) glucose tolerance
c) fasting blood sugar estimates

Diagnosis

positive results on lab work, i.e. glycosurea (sugar in urine)

Management

a) diet restriction (50 percent of diabetics can be treated through diet control alone)
b) oral hypoglycemic medications
c) insulin
d) combination of above therapies
e) follow-up: may observe frequent office visits (every 2 weeks) for several months following initial diagnosis
   - mean # annual physician visits = 4.4 (Hamff, 1979)
   - physical exam and new lab test = once or twice annually once controlled
   - mean duration between reassessments = 8.5 months (Lawrence and Cheely, 1980)
   - modal duration between reassessments = 6 months or 2/year (Lawrence and Cheely, 1980)
f) may observe referral to specialist
g) may observe annual inpatient utilization of 21-33 days (DHEW, 1978)
h) frequently observed complications (DuPree and Meyer, 1980):
   a) renal disease

b) cardiovascular disease (most frequent cause of death among diabetics)
c) hypertension (frequency runs from 10.5-68% among diabetics)
d) visual disorders
e) podalic problems

Urinary Tract Infections (UTI)

1. Functional Impact: Can be mild, especially if treated early, but severe cases can involve renal damage.

2. Diagnosis: Fairly clear-cut based on generally accepted criteria of more than 100,000 organisms of bacteria/ml of urine. Can also be a secondary infection to other diseases.

3. Prevalence: According to BCBSM data, UTI was the eleventh leading diagnosis, comprising 1.6 percent of billed services. Interestingly though, the average charge/service for UTI was $10.44 compared to $8.28 for diabetes (the number three diagnosis and $10.21 for the number two diagnosis, hypertension).

   Average BCBSM payments were $6.62. Of specific diseases of the genitourinary system, UTI was the leading diagnosis, with 123,305 services.

4. Impact of Care: Generally, the disease is responsive to drug treatment. If patient is acutely ill, however, hospitalization may be required as well.

5. Management: Criteria for treatment are readily available in the literature and general agreement exists on appropriate management.

6. Epidemiology: Has been fairly well studied and is generally understood.

7. Latitude: There is latitude in management since, based on physician opinion, office-based or hospital-based treatment can be given; frequent lab cultures can be made, etc. Some non-elective procedures can be identified.

8. Population Affected: The disease is most common among women and has been shown to vary with age. Can be especially problematic to women of child-bearing age.

9. General Pros and Cons: UTI is a popular tracer condition because, though often sex-related, a wide age band of women can be observed. Also, as LoGerfo (1978) observed, the disease is commonly seen in ambulatory settings and offers excellent opportunity to observe methodological (process)

issues in physician behavior such as screening and laboratory utilization.

10. Explicit Criteria: Criteria for diagnosis and treatment of urinary tract infection include the following.

Evaluation

family history and physical exam (pelvic and/or rectal)
laboratory work:

a) quantitative urine culture
b) microscopic exam of sediment in urine

Diagnosis

high organism count (greater than 100,000/ml urine); fever, chills, pain (optional); obstruction or bleeding (optional); UTI is often a complicating condition in pregnancy or for diabetics

Management

a) drug therapy with antibiotics for 7-14 days
b) may require hospitalization if obstruction accompanies
c) may require referral to urologist if severe
d) retesting: repeat urine culture one week after treatment is stopped
   conduct IVP in patients with history of recurrence
e) one office follow-up 7-14 days after retest is results are negative
   - mean # visits = 3-4 over course of illness in routine cases (LoGerfo, 1978)

7.4 Data Sources

The tracer analyses will be conducted using three analytic tracer files. Each tracer file represents a diagnostic group which corresponds to one of our three selected tracer conditions: essential benign hypertension, diabetes mellitus (adult onset), and acute urinary tract infection. Contained within each file will be individual utilization histories (longitudinal records) for a sample of patients with that tracer condition.

By structuring the files in this way, two types of analyses can be performed. First, analyses of either aggregate or disaggregated utilization rates and charges across tracer groups are carried out. In this case the unit of analysis is the diagnostic group or some subset of that group. Second, analyses of variations in utilization and charges disaggregated within diagnostic groups are done to observe utilization and charge differences among beneficiaries with the same diagnosis. In this case, the unit of analysis is the beneficiary. As discussed in a subsequent section, major portions of our analyses will be of this latter type.

7.4.1 Medicare Claims Data

The tracer files and patient utilization histories were created from Medicare Part B claims data in the following manner. The sampling frame for each tracer includes all patients who submitted claims during the first quarter of 1980 for treatment of one of the three tracer diagnoses. We then created individual longitudinal utilization records covering the entire period, 1980, for sample patients in each tracer file. This was done by using the patient's identification numbers to select all their Medicare claims submitted during 1980, regardless of whether they were for treatment of the particular tracer. Claims were then aggregated up to the patient level by type of service and location.

7.4.2 Secondary Data

County and market area characteristics were merged on to the analytic files to account for expected supply and demand influences on utilization and charge rates. County level information from Census Bureau publications was aggregated into the 15 market areas.

7.5 Descriptive Results for Three Diagnostic Tracers

7.5.1 Overview of Results

This section provides descriptive results on physicians' charges, utilization and unit prices for the three diagnostic tracers, based on 1980 Michigan Medicare claims data. All charge data have been deflated by geographical cost-of-living differences. In some instances, charges were also deflated by an index measuring health status. See Appendix G for a detailed discussion of this index and its creation. Utilization rates are presented on a per Medicare beneficiary basis.

Variations in charges, unit prices and utilization are compared across fifteen market areas in Michigan. The descriptive tables which follow are presented by market area, ranked according to their physician-population ratio. In 1980, the physician/population ratio (MDPOP) ranged from a high of 235 physicians per 100,000 population (Oakland) to a low of 88 per 100,000 in the Bay area. The principal city within each market area is given in parentheses, allowing for city size comparisons to be made.

The next sub-section provides a brief overview of characteristics within the diabetes, hypertension and urinary tract infection samples. Total physician charges per beneficiary within each tracer are analyzed in Section 7.5.3. A breakdown of total charges into eight selected ancillary services is presented in Section 7.5.4. Finally, Section 7.5.5 looks at utilization versus unit price differences across the market areas to explain the variation in ancillary physician service charges per beneficiary.

7.5.2 Tracer Characteristics

Table 7-1 provides a descriptive profile of the three tracer groups by market area. Wayne is by far the largest market area, representing about 21 percent of all beneficiaries while Berrien had the fewest beneficiaries in each tracer sample (0.7% - 1.3%).

The percentage distribution is almost identical across the market areas, implying a similar incidence pattern for each diagnostic tracer.

Population figures for the principal cities within each market area are also shown in Table 7-1. Less than 50,000 people resided in seven of the fifteen largest cities in 1980 with four (Traverse City, Petoskey, St. Joseph, and Mt. Clemens) having fewer than 20,000 inhabitants. Conversely, over 1.2 million people resided in Detroit.

Table 7-1

BENEFICIARY DISTRIBUTION FOR DIAGNOSTIC

TRACERS BY MARKET AREA

Market Area	City Population*	Diabetes	Hypertension	UTI
Oakland (Pontiac)	76,715	6.4%	7.7%	10.6%
Grand Traverse (Trav. City)	15,516	2.7	2.3	2.7
Ingham (Lansing)	130,414	5.2	3.3	5.0
Washtenaw (Ann Arbor)	107,966	5.4	5.3	6.3
Wayne (Detroit)	1,203,339	21.3	21.7	21.4
Muskegon (Muskegon)	40,823	3.9	4.5	2.1
Kalamazoo (Kalamazoo)	79,722	8.7	11.5	6.5
Genesee (Flint)	159,611	12.1	10.6	13.1
Emmett (Petoskey)	6,097	2.0	2.0	2.3
Berrien (St. Joseph)	9,622	0.7	1.1	1.3
Kent (Grand Rapids)	181,843	10.9	11.8	7.0
Saginaw (Saginaw)	77,508	3.7	3.5	6.6
Macomb (Mt. Clemens)	18,806	7.3	5.9	7.2
Marquette (Marquette)	23,288	3.0	3.9	3.7
Bay (Bay City)	41,593	6.6	4.9	4.2
TOTAL		100.0%	100.0%	100.0%
		(N=12,239)	(N=13,439)	(N=5,676)

* 1980 Population data (Source: Bureau of the Census, 1982).
N = beneficiary sample sizes.

7.5.3 Total Charges Per Beneficiary For Diagnostic Tracers

Mean total physician charges for each tracer group by market area are shown in Table 7-2 expressed in both undeflated (CTOT) and deflated terms. Total charges were adjusted in two steps. First, they were deflated by a cost-of-living index specific to each market area (DCTOT). A second adjustment was made to account for each beneficiary's health status differences within each tracer (DCTOT/HSI). This was done by dividing COL-adjusted (CTOT) value by a health status index (HSI). Lower HSIs imply a healthier population. Therefore, deflating by HSI results in healthier areas having their costs increased and vice-versa for "sicker" populations for comparison purposes. (See Appendix G for a detailed description of how HSI was created.)

7.5.4 Diabetes Total Charges Per Beneficiary by Market Area

Total charges per diabetes beneficiary exhibit significant differences across market areas, even in deflated terms. Adjusted charges ranged from a high of $934 (see column 3) in Oakland to a low of $515 in Berrien, a difference of $419. In undeflated terms, the gap was 12 percent larger ($471), implying that interarea cost-of-living and health status explain only a small fraction of the geographic differences.

No relation between adjusted charges and physician/population ratios is apparent for the diabetes group although physician-dense Oakland's figure far exceeds that found in the physician-scarce Bay area. Interestingly, the three areas with the smallest cities (Grand Traverse, Emmett and Berrien) do exhibit the lowest charges in both deflated and undeflated terms.

7.5.5 Hypertension Total Charges Per Beneficiary by Market Area

Lower charges in smaller central cities regardless of physician/population ratios are also found in the hypertension group. In COL and HSI deflated terms, three of the four market areas exhibiting the lowest charges also had less than 25,000 people in its major city.

Table 7-2

TOTAL MEDICARE CHARGES PER BENEFICIARY FOR THREE TRACERS BY MARKET AREA (DEFLATED AND UNDEFLATED)*

	DIABETES			HYPERTENSION			UTI		
MARKET AREA	CTOT	DCTOT	DCTOT/HSI	CTOT	DCTOT	DOCTOT/HSI	CTOT	DCTOT	DCTOT/HSI
Oakland (Pontiac)	$918	$943	$934	$868	$835	$795	$1,121	$1,078	$1,067
Grand Traverse (Traverse City)	515	531	547	476	491	517	713	743	750
Ingham (Lansing)	573	567	585	593	581	606	804	796	821
Washtenaw (Ann Arbor)	627	615	634	533	523	539	775	760	780
Wayne (Detroit)	919	884	866	843	811	787	1,257	1,209	1,173
Muskegon (Muskegon)	629	676	663	558	600	606	832	904	904
Kalamazoo (Kalamazoo)	637	650	670	565	577	601	751	766	807
Genesee (Flint)	757	765	765	747	755	726	924	933	897
Emmett (Petoskey)	538	549	528	536	547	558	718	733	755
Berrien (St. Joseph)	510	520	515	439	448	462	702	716	770
Kent (Grand Rapids)	616	642	662	534	556	579	677	705	742
Saginaw (Saginaw)	656	663	663	682	689	669	775	791	775
Macomb (Mt. Clemens)	860	827	765	797	766	744	1,141	1,097	1,055
Marquette (Marquette)	575	639	694	348	387	434	583	648	720
Bay (Bay City)	655	675	649	563	574	563	786	810	810

* CTOT = Undeflated Total Medicare Charges

DCTOT = CTOT/Cost-of-Living Index

DCTOT/HSI = DCTOT/Health Status Index

Again, Oakland has the highest real charges per beneficiary, but the link between physician/population ratios is still tenuous. Grand Traverse ranks second in the number of physicians per 100,000 population yet only averages $517 per beneficiary, the third lowest level in the state. Conversely, Macomb, which has a relatively low MDPOP ratio, ranked third in average charges for the hypertension group. A possible explanation is Macomb's close proximity to both Oakland and Wayne. As we shall see later, physicians in Macomb's market area imitate their colleagues in nearby Oakland and Wayne in charges, utilization, and unit prices.

7.5.6 Urinary Tract Infection Total Charges Per Beneficiary by Market Area

Total charges per Medicare beneficiary with Urinary Tract problems appear somewhat higher compared to the other two diagnostic tracers. In fact, three areas exhibited charge levels totalling over $1,000 per beneficiary even after adjusting for both cost-of-living and health status differences. The relatives by market area remained essentially unaffected, however.

7.6. Ancillary Charges Per Beneficiary

Tables 7-3, 7-4, and 7-5 present 1980 average ancillary charges per beneficiary by market area for the three tracers, adjusted for both cost-of-living and health status differences. Total charges are also provided to show the relative importance of each ancillary service to overall charges. Surgery, emergency treatment, anesthesia and physician inpatient (non-consulting) visits were included in the INPATIENT category. X-RAY includes both diagnostic and therapeutic procedures. Medical supplies, ambulance services, and injections were aggregated into the miscellaneous (MISC) category. Consult includes all visits with consulting codes.

7.6.1 Diabetes Ancillary Charges per Beneficiary

Ancillary physician services per beneficiary for the diabetes tracer are presented in Table 7-3. Inpatient physician charges clearly represent the greatest percentage of total charges, ranging from 39 percent in Oakland to over 55 percent in Muskegon. Muskegon also had the highest absolute level of inpatient charges ($371 per beneficiary), almost $100 more than the lowest area (Grand Traverse). Remember that all of these figures are population-based, and include hospitalizations outside the market area.

Marquette, the Upper Peninsula market area, exhibits average inpatient physician charges of $362 per beneficiary which exceeds every other area besides Muskegon. Higher inpatient charges may be indicative of higher admission rates which may be the result of physician scarcity. Physicians may be substituting hospital care for office visits in an effort to meet greater medical care demands. Another contributing factor could be that by the time Medicare beneficiaries seek care in physician-scare areas, they are more seriously ill, a possibility not reflected in our health status index *per se*.

Table 7-3

1980 MEDICARE ANCILLARY SERVICE CHARGES
PER BENEFICIARY ADJUSTED FOR COST-OF-LIVING
AND HEALTH STATUS BY MARKET AREA: DIABETES

Market Area	Total*	Inpatient	X-ray	Nursing Home	Special Studies	Lab	Consult	Office	Misc.
Oakland (Pontiac)	$934	$361	$82	$33	$72	$147	$35	$122	$81
Grand Traverse (Traverse City)	547	274	43	9	21	66	16	72	46
Ingham (Lansing)	585	283	54	18	42	51	17	67	52
Washtenaw (Ann Arbor)	634	314	62	19	32	60	22	77	49
Wayne (Detroit)	866	358	85	28	66	129	32	102	66
Muskegon (Muskegon)	663	371	55	13	21	40	21	87	54
Kalamazoo (Kalamazoo)	670	327	74	18	24	47	20	82	79
Genesee (Flint)	765	308	78	15	70	108	24	77	84
Emmett (Petoskey)	528	291	40	13	23	48	17	68	28
Berrien (St. Joseph)	515	283	48	10	15	29	13	73	43
Kent (Grand Rapids)	662	353	58	17	26	55	19	64	69
Saginaw (Saginaw)	663	300	49	16	38	87	17	68	88
Macomb (Mt. Clemens)	795	319	80	18	71	129	26	90	62
Marquette (Marquette)	694	362	50	22	18	47	19	75	100
Bay (Bay City)	649	342	46	9	48	78	31	51	47

* Total charges may not equal sum of ancillary charges due to rounding. Total charges taken from Column 3, Table 7-2.

Examining the other ancillary charges, we find much more systematic variation by market area. In fact, charges for lab tests were five times greater in Oakland than in Berrien. Beneficiaries in five market areas were charged less than $50 for lab tests while another four had adjusted lab charges totalling more than $100. Charges for special studies ranged between $15 per beneficiary in Berrien to over $70 in Oakland, more than a four-fold difference. All other services showed at least a doubling effect between the lowest and the highest areas.

Summarizing market area differences, we find that:

- Oakland had the highest charges per beneficiary in five of the seven ancillaries;
- Oakland, Wayne, and Macomb, which make up the Detroit metropolitan area, were among the top five market areas (charge-wise) in every ancillary category except miscellaneous services; and
- market areas with small central cities (Emmett, Berrien and Grand Traverse) generally were associated with lower charges compared to the rest of the state.

7.6.2 Hypertension Ancillary Charges per Beneficiary

Charges for Medicare patients with hypertension are presented in Table 7-4. Again, we find the largest fraction of total physician charges going for inpatient services with roughly the same percentages as those found in the diabetes tracer. However, inpatient charges for hypertension patients were generally lower relative to the diabetes group (the only exception being Ingham and Saginaw). One interesting difference is the low inpatient charges for Marquette beneficiaries with hypertension compared with those having diabetes. No explanation is immediately obvious.

Dramatic differences in charges among the fifteen areas include:

- a four-fold difference between lab charges in Oakland ($112) versus Berrien ($23) and between charges for special studies in Macomb ($74) versus Marquette ($14); and
- miscellaneous charges three times higher in Genesee compared to the Berrien area.

Table 7-4

1980 MEDICARE ANCILLARY SERVICE CHARGES
PER BENEFICIARY ADJUSTED FOR COST-OF-LIVING
AND HEALTH STATUS BY MARKET AREA: HYPERTENSION

Market Area	Total*	Inpatient	X-ray	Nursing Home	Special Studies	Lab	Consult	Office	Misc.
Oakland (Pontiac)	$795	$308	$79	$22	$63	$112	$29	$116	$67
Grand Traverse (Traverse City)	517	254	48	7	17	52	13	89	35
Ingham (Lansing)	606	297	64	14	36	42	15	87	48
Washtenaw (Ann Arbor)	539	256	53	10	32	45	14	87	40
Wayne (Detroit)	787	327	75	21	61	109	28	112	54
Muskegon (Muskegon)	606	333	50	13	26	34	21	96	34
Kalamazoo (Kalamazoo)	601	305	73	11	24	30	19	91	47
Genesee (Flint)	726	294	70	16	69	95	21	85	75
Emmett (Petoskey)	558	263	45	5	28	50	16	80	71
Berrien (St. Joseph)	462	264	45	6	16	23	12	74	22
Kent (Grand Rapids)	579	296	56	11	28	44	16	79	48
Saginaw (Saginaw)	669	319	58	12	40	74	20	80	66
Macomb (Mt. Clemens)	744	299	79	14	74	102	27	105	44
Marquette (Marquette)	434	215	39	9	14	36	11	77	34
Bay (Bay City)	563	272	49	5	51	55	23	70	38

* Total charges may not equal sum of service charges due to rounding. Total charges taken from Column 6, Table 7-2.

Again, no obvious trends were found by areas ranked by their physician/population ratio, except that Oakland did have the highest physician charges for x-rays, nursing home visits, lab tests, consultations, and office visits. Oakland ranked in the top three for the remaining two categories.

If we examine charges according to central city population, the following trends result:

- Wayne's charges per hypertension patient rank among the top five in all categories; and

- small city areas (Berrien, Emmett, and Grand Traverse) exhibit lower charges for all physician ancillaries compared to the densely populated area (Wayne).

Nevertheless, Macomb, which ranks twelfth in central city size, has higher physician costs, on average, than for all other "small city areas." Bordercrossing is not evident when we use effective population figures for Macomb. However, Macomb's close proximity to both the Oakland and Wayne areas may have some unexplained influence on charges.

Finally, the Upper Peninsula (Marquette) charges were considerably lower for the physician inpatient services, x-rays, special studies, and consultations. Apparently, restricted access to physician care is having a dampening effect on charges for beneficiaries with hypertension in truly isolated areas.

7.6.2 Urinary Tract Infection Ancillary Charges per Beneficiary

Table 7-5 shows ancillary charge data for the third tracer, urinary tract infection. Several interesting comparisons can be made between the UTI tracer and the other two. For example,

- higher inpatient service charges for UTI patients are found in every market area compared to both diabetes and hypertension groups;

- x-ray and consult charges are greater than those for hypertension;

- office, consult and lab charges exceed charges incurred by diabetes patients in every market area;

- Muskegon had the highest physician charges per patient for inpatient services, a result found in the other tracers as well; and

Table 7-5

1980 MEDICARE ANCILLARY SERVICE CHARGES
PER BENEFICIARY ADJUSTED FOR COST-OF-LIVING
AND HEALTH STATUS BY MARKET AREA:
URINARY TRACT INFECTION

Market Area	Total*	Inpatient	X-ray	Nursing Home	Special Studies	Lab	Consult	Office	Misc.
Oakland (Pontiac)	$1,067	$453	$93	$30	$71	$143	$47	$132	$97
Grand Traverse (Traverse City)	750	423	61	25	23	65	23	88	40
Ingham (Lansing)	821	452	76	27	45	66	23	82	51
Washtenaw (Ann Arbor)	832	400	76	23	32	84	24	86	75
Wayne (Detroit)	1,173	487	136	35	79	164	49	140	82
Muskegon (Muskegon)	904	525	80	20	15	41	42	107	71
Kalamazoo (Kalamazoo)	807	392	101	16	31	48	32	106	77
Genesee (Flint)	897	395	104	10	73	116	31	104	64
Emmett (Petoskey)	755	434	67	12	26	65	28	76	46
Berrien (St. Joseph)	770	482	61	3	30	20	21	105	48
Kent (Grand Rapids)	742	422	64	13	20	37	27	88	71
Saginaw (Saginaw)	775	424	70	9	37	56	26	73	80
Macomb (Mt. Clemens)	1,055	458	101	19	79	146	49	109	93
Marquette (Marquette)	720	428	56	26	15	56	21	83	36
Bay (Bay City)	810	375	60	15	65	80	32	93	89

* Total charges may not equal sum of service charges due to rounding. Total charges taken from Column 9, Table 7-5.

- the Upper Peninsula area (Marquette) had low charge levels resembling those in the hypertension tracer.

Finally, significant differences in beneficiary charges were found among the market areas. Specifically,

- charges for special studies, lab tests and nursing home visits were five to eleven times greater between the high and low areas. Wayne market area in particular had very high physician charges per beneficiary compared to the rest of Michigan, ranking highest for six of the eight service types.

7.7 Ancillary Utilization and Unit Prices for Diagnostic Tracers

In this section we examine ancillary service utilization and unit prices for each tracer. Utilization rates are defined as the average number of services (e.g., hospital or office visits) per beneficiary, including those without any use. All unit prices have been adjusted for market area differences in cost-of-living.

7.7.1 Diabetes Utilization and Unit Prices

Tables 7-6 and 7-7 show market area use rates and unit prices for ancillaries in the diabetes tracer. Looking first at Table 7-6, we see that beneficiaries received more lab tests, physician inpatient services, and office visits than any other type of care. Lab tests ranged from 5 per beneficiary in Berrien to over 20 in Oakland, representing a four-fold difference. Four market areas (Oakland, Wayne, Genesee and Macomb) had more than 18 lab tests per diabetic patient, indicating that patients in large urban areas undergo more lab testing than elsewhere. Office visit rates were almost two times higher in Oakland (8.41 visits per beneficiary) compared to the Bay area (4.4 visits). Inpatient physician visit ranges exhibited much less variation across Michigan (only a 32% difference). Nursing home visits by physicians ranged from just over one-half visit (.56) per patient per year in the Bay area to nearly 2 visits (1.96) in Oakland. Similarly, special studies use rates, although low in absolute terms, varied nearly 300 percent (from .54 studies in Marquette to over 2 in Oakland). Patients were least likely to have consultations relative to other types of care. In thirteen of the fifteen market areas, less than 50 consultations per 100 beneficiaries were provided. Surprisingly, the Bay area exhibited a very high frequency rate (55 per 100 beneficiaries) considering it has the lowest MDPOP ratio.

Areas with the greatest physician supply per capita do not show consistently higher use rates relative to areas with low physician supply. However, with the exception of inpatient services, we do find that Oakland exhibited uniformly greater physician use rates than the Bay area, just as it did with average charges.

Average physician charges per ancillary service, or unit prices, are provided in Table 7-7 for the diabetes group. We find that unit prices for services have much less variation across the market areas compared to differences found in utilization rates. In fact, only unit prices for physician visits to nursing homes and for miscellaneous services showed any substantial variation. Conversely, unit prices for lab tests, consultations and office visits varied only 24-33 percent, compared with 100-300 percent differences in use rates.

Table 7-6

FREQUENCY OF ANCILLARY SERVICES PER BENEFICIARY BY MARKET AREA: DIABETES

Market Area	Inpatient	X-ray	Nursing Home	Special Studies	Lab	Consult	Office	Misc.
Oakland (Pontiac)	8.90	3.40	1.96	2.05	20.39	0.61	8.41	3.97
Grand Traverse (Traverse City)	7.87	2.52	0.68	0.81	10.67	0.27	5.71	2.51
Ingham (Lansing)	7.52	2.60	1.09	1.49	7.70	0.32	5.10	1.82
Washtenaw (Ann Arbor)	7.38	3.00	1.04	1.04	9.53	0.39	5.58	2.23
Wayne (Detroit)	9.76	3.63	1.50	1.85	18.14	0.53	7.10	4.05
Musekgon (Muskegon)	9.48	2.87	0.97	0.62	6.86	0.40	6.47	2.00
Kalamazoo (Kalamazoo)	8.57	3.38	0.99	0.78	7.77	0.38	5.97	2.85
Genesee (Flint)	7.48	3.45	0.98	1.92	18.04	0.43	5.97	3.65
Emmett (Petoskey)	8.75	1.97	1.02	0.73	8.60	0.36	5.38	1.38
Berrien (St. Joseph)	7.51	2.51	0.77	0.80	5.27	0.27	5.89	1.12
Kent (Grand Rapids)	8.08	2.59	1.13	0.87	8.80	0.35	4.76	2.64
Saginaw (Saginaw)	7.78	2.47	1.06	1.08	13.64	0.31	5.30	4.44
Macomb (Mt. Clemens)	8.35	3.46	1.27	2.01	18.69	0.44	6.77	4.41
Marquette (Marquette)	8.91	1.99	0.68	0.54	7.26	0.31	5.55	1.97
Bay (Bay City)	9.38	2.55	0.56	1.68	13.65	0.55	4.40	2.64

Highlights of market area patterns for various physician and ancillary unit prices include the fact that:

- o Oakland had very high unit prices in five of the eight categories;
- o Wayne ranked in the top four according to unit prices for all but the INPATIENT and MISC categories.
- o Unit prices in low MDPOP areas were surprisingly similar to those found in high MDPOP areas.

Market area variations in ancillary use versus unit prices indicate that in all cases ancillary use rates varied far more across areas than unit prices. For instance, market area variations for lab tests charges per beneficiary were almost entirely due to utilization differences. Oakland had by far the highest lab charges in the state, due primarily to high frequency. Marquette's low lab use explains practically all of its low lab cost per beneficiary.

7.7.2 Hypertension Utilization and Unit Prices

Physician and ancillary service use rates for hypertension are shown in Table 7-8. Compared to the diabetes tracer, utilization rates for the inpatient, lab and consult services were lower while the number of office visits were higher for hypertension patients.

Upon examining variations in use rates for the market areas, it appears that Oakland, Wayne, Macomb and Genesee (large metro areas) generally have greater ancillary utilization compared with areas with smaller major cities. In fact, Wayne and Oakland were among the top three areas in frequency of service utilization in every category. No obvious physician/population effects were apparent in the data.

Table 7-7

AVERAGE PHYSICIAN CHARGES PER SERVICE BY MARKET AREA (DEFLATED): DIABETES

Market Area	Inpatient	X-ray	Nursing Home	Special Studies	Lab	Consult	Office	Misc.
Oakland (Pontiac)	$65.65	$25.35	$16.61	$33.92	$6.74	$60.24	$15.93	$26.17
Grand Traverse (Traverse City)	53.91	17.12	11.70	25.96	5.65	57.47	13.11	25.38
Ingham (Lansing)	58.81	20.31	18.93	25.82	6.64	52.97	13.17	27.37
Washtenaw (Ann Arbor)	73.01	19.31	20.52	30.58	5.57	54.29	14.54	24.22
Wayne (Detroit)	54.66	22.41	24.15	33.86	6.55	60.96	15.59	19.41
Muskegon (Muskegon)	62.57	18.77	14.40	31.29	6.05	54.11	14.64	39.44
Kalamazoo (Kalamazoo)	70.53	20.96	21.25	27.71	5.68	51.46	13.80	28.63
Genesee (Flint)	70.42	23.40	15.49	32.92	5.84	57.07	13.93	26.35
Emmett (Petoskey)	54.86	19.35	11.07	29.89	5.79	48.41	13.19	26.79
Berrien (St. Joseph)	49.94	20.18	15.14	20.61	5.05	49.54	12.81	26.48
Kent (Grand Rapids)	59.73	22.29	15.84	26.93	5.74	52.23	13.92	29.27
Saginaw (Saginaw)	58.33	17.92	20.45	33.08	6.06	55.13	13.35	27.52
Macomb (Mt. Clemens)	58.76	22.96	14.33	34.53	6.49	59.97	14.61	18.63
Marquette (Marquette)	62.06	20.16	20.54	34.33	5.84	56.12	12.87	40.93
Bay (Bay City)	51.80	18.81	16.78	29.40	5.73	58.34	14.15	26.22

Table 7-8

FREQUENCY OF ANCILLARY SERVICES PER BENEFICIARY BY MARKET AREA: HYPERTENSION

Market Area	Inpatient	X-ray	Nursing Home	Special Studies	Lab	Consult	Office	Misc.
Oakland (Pontiac)	7.48	3.55	1.56	1.84	15.41	0.51	8.43	4.17
Grand Traverse (Traverse City)	5.21	2.31	0.44	0.62	8.32	0.21	7.07	2.66
Ingham (Lansing)	7.02	2.85	0.93	1.39	5.82	0.29	6.91	2.11
Washtenaw (Ann Arbor)	5.06	2.68	0.74	1.09	6.57	0.26	6.16	2.04
Wayne (Detroit)	7.97	3.46	1.12	1.76	14.51	0.47	8.11	4.14
Muskegon (Muskegon)	7.44	2.48	0.52	0.82	5.14	0.37	6.72	1.84
Kalamazoo (Kalamazoo)	6.61	3.20	0.66	0.79	4.56	0.35	6.70	2.32
Genesee (Flint)	6.57	3.20	0.93	2.04	15.52	0.40	6.60	3.65
Emmett (Petoskey)	6.61	2.16	0.48	0.83	7.21	0.32	5.65	2.02
Berrien (St. Joseph)	5.06	2.08	0.49	0.77	3.60	0.23	5.77	1.22
Kent (Grand Rapids)	5.55	2.36	0.74	0.97	6.48	0.30	5.88	2.52
Saginaw (Saginaw)	7.75	3.23	0.92	1.24	11.12	0.38	6.80	4.46
Macomb (Mt. Clemens)	7.34	3.36	0.90	2.01	13.83	0.47	7.91	4.00
Marquette (Marquette)	6.45	1.50	0.53	0.44	5.00	0.18	5.53	1.77
Bay (Bay City)	6.25	2.44	0.36	1.62	8.42	0.41	5.55	2.14

Unit prices for hypertension services are shown in Table 7-9. Except for Marquette, prices per inpatient services are higher, area for area, compared to those found for diabetes patients (See Table 7-7). Interestingly, the highest unit price ($92) was found in Berrien (a small city area) almost double the value for patients with diabetes. In addition, while only 20 percent of the market areas had physician charges per inpatient service totalling over $70 in the diabetes tracer, we find 60 percent of them do in this tracer. Because this category includes several different kinds of inpatient services and visits, we have no way of knowing whether hypertension patients are actually undergoing more complex inpatient care, but this appears to be the case.

Two ancillaries, nursing home visits and miscellaneous services, also showed considerable price variation across areas (over 100% each). The remaining four categories varied between 25-39 percent.

Total office visit charges per beneficiary ranged from a low of $70 (Bay) to over $115 (Oakland), see Table 7-4, a difference of 66 percent. Again, Oakland beneficiaries had more office visits and higher average prices per visit. As a result, patients were charged the most for office visits in 1980. Bay had an unusually high average price for an office visit, the second highest in the state. This was offset by very low utilization rates. Consequently, per patient charges in Bay were the lowest relative to all other market areas.

Finally, inpatient services was the only case where the variation in unit prices exceeded differences in utilization. This is due, no doubt, to the heterogeneous mix of services, e.g. routine visits, surgery.

7.7.3 UTI Utilization and Unit Prices

The last two tables provide use rates and average prices for the Urinary Tract Infection tracer. Comparisons with the use rates for the other tracers show that:

- higher inpatient care utilization compared to the other two tracers, (with the one exception being inpatient use for diabetes patients in Bay);
- greater use of consultations (ranging from 37-80 consultations per 100 patients) than was seen in either the hypertension or diabetes groups; and
- a higher frequency of office visits and x-rays for this tracer.

Table 7-9

AVERAGE PHYSICIAN CHARGE PER SERVICE
BY MARKET AREA (DEFLATED): HYPERTENSION

Market Area	Inpatient	X-ray	Nursing Home	Special Studies	Lab	Consult	Office	Misc.
Oakland (Pontiac)	$66.75	$25.03	$13.85	$33.04	$7.43	$58.87	$15.78	$22.00
Grand Traverse (Traverse City)	76.27	19.15	12.85	25.37	5.73	57.10	12.92	18.66
Ingham (Lansing)	72.80	22.29	16.82	24.80	7.22	50.84	12.95	18.86
Washtenaw (Ann Arbor)	85.21	19.60	13.54	26.85	6.51	52.22	14.57	21.54
Wayne (Detroit)	61.89	21.82	15.98	32.95	7.38	60.73	15.17	16.75
Muskegon (Muskegon)	81.43	19.60	22.97	32.94	6.23	54.40	15.24	30.17
Kalamazoo (Kalamazoo)	81.97	21.73	18.78	28.18	6.38	52.13	13.70	25.50
Genesee (Flint)	73.84	23.71	19.29	32.33	6.41	56.01	14.15	23.98
Emmett (Petoskey)	51.44	18.92	10.04	32.08	6.86	47.80	13.83	21.54
Berrien (St. Joseph)	92.06	21.83	10.31	20.05	5.78	49.13	12.66	24.02
Kent (Grand Rapids)	80.00	22.61	17.16	26.14	6.52	52.35	13.93	23.59
Saginaw (Saginaw)	67.09	18.01	13.79	31.37	6.40	55.93	13.17	25.79
Macomb (Mt. Clemens)	59.12	23.12	14.98	34.76	7.11	59.06	14.52	14.43
Marquette (Marquette)	44.78	19.83	18.36	28.53	6.08	53.29	12.83	24.65
Bay (Bay City)	73.53	21.34	13.62	31.02	6.67	57.38	15.25	18.72

Table 7-10

FREQUENCY OF ANCILLARY SERVICE PER BENEFICIARY BY MARKET AREA: URINARY TRACT INFECTION

Market Area	Inpatient	X-ray	Nursing Home	Special Studies	Lab	Consult	Office	Misc.
Oakland (Pontiac)	11.31	3.93	1.92	1.89	18.84	0.80	9.41	6.21
Grand Traverse (Traverse City)	9.88	3.10	1.64	0.80	9.40	0.41	7.40	3.33
Ingham (Lansing)	9.84	3.51	1.11	1.63	9.64	0.44	6.31	2.73
Washtenaw (Ann Arbor)	7.67	3.52	1.47	0.94	11.65	0.43	6.24	4.19
Wayne (Detroit)	12.59	5.67	1.87	2.19	21.65	0.82	10.02	6.78
Muskegon (Muskegon)	12.28	4.32	1.30	0.61	6.32	0.75	7.85	3.54
Kalamazoo (Kalamazoo)	9.86	4.52	0.75	0.99	7.52	0.55	7.56	2.84
Genesee (Flint)	8.62	4.55	0.64	2.14	18.04	0.57	8.89	6.21
Emmett (Petoskey)	10.99	3.34	0.88	0.83	8.88	0.54	6.04	2.11
Berrien (St. Joseph)	10.31	3.64	0.39	0.69	3.13	0.37	7.89	1.77
Kent (Grand Rapids)	9.29	2.85	0.86	0.71	5.67	0.50	6.80	4.13
Saginaw (Saginaw)	9.97	4.03	0.73	1.12	9.11	0.51	5.97	4.82
Macomb (Mt. Clemens)	11.82	4.74	1.32	2.39	19.93	0.84	8.50	6.40
Marquette (Marquette)	9.85	1.94	1.60	0.47	6.93	0.37	5.49	1.28
Bay (Bay City)	8.79	3.18	1.00	1.95	11.45	0.56	7.05	5.76

As far as patterns among the market areas are concerned, we find the largest metro area (Wayne) has consistently high use rates for all types of UTI services, ranking either first or second. Nearby market areas, Oakland and Macomb, also show higher ancillary frequencies than elsewhere while the opposite is true for the small central city areas (i.e., Berrien, Emmett and Grand Traverse). Moreover, Marquette experienced very low use rates (the lowest in four cases) reflecting restricted physician supply in this Upper Peninsula area. Again, we found no consistent physician supply pattern among the fifteen market areas.

Average prices per physician service (seen in Table 7-11) do not appear that much different than in previous tables. Areas with the highest average price for nursing home visits (Ingham) and miscellaneous services (Kalamazoo) were <u>two and a half times greater</u> than those areas with the lowest unit prices. Little variation was found in unit prices for the other ancillaries. For example, unit prices in the special studies, lab, and office categories varied 29-32 percent across Michigan. Consultation prices averaged between $49 and $61, a difference of less than 25 percent.

Since unit price variation was quite narrow for all but two ancillaries (nursing home visits and miscellaneous services), most variation in average charges per beneficiary (see Table 7-5) are again due to discrepancies in use rates among the market areas. Lab test utilization in the Wayne area, for instance, was <u>seven</u> times that in Berrien. Wayne also had very high average prices per lab test (even COL-adjusted). As a result, UTI lab charges per beneficiary ($164) were found in Wayne, with Berrien experiencing the lowest levels ($20 per beneficiary) in the state.

Table 7-11

AVERAGE PHYSICIAN CHARGES PER SERVICE
BY MARKET AREA (DEFLATED): URINARY TRACT INFECTION

Market Area	Inpatient	X-ray	Nursing Home	Special Studies	Lab	Consult	Office	Misc.
Oakland (Pontiac)	$60.42	$25.15	$15.90	$35.00	$7.10	$59.06	$15.74	$19.41
Grand Traverse (Traverse City)	68.03	18.52	16.58	29.29	6.22	54.72	12.20	20.84
Ingham (Lansing)	70.42	22.34	27.18	24.85	6.60	51.27	13.49	25.18
Washtenaw (Ann Arbor)	79.15	20.27	14.22	30.27	6.15	52.09	14.29	25.72
Wayne (Detroit)	58.48	24.10	21.15	35.30	7.20	61.28	15.44	17.05
Muskegon (Muskegon)	55.23	17.75	14.21	28.05	6.58	52.77	14.84	23.55
Kalamazoo (Kalamazoo)	70.84	21.50	19.44	29.54	5.85	55.60	13.97	39.26
Genesee (Flint)	74.03	24.57	14.33	31.72	6.61	55.71	14.16	15.49
Emmett (Petoskey)	52.46	19.21	11.59	32.49	7.62	49.20	13.08	17.19
Berrien (St. Joseph)	68.48	15.99	11.00	28.25	6.23	52.28	13.13	25.32
Kent (Grand Rapids)	66.73	21.01	18.07	27.02	5.83	51.09	13.45	20.46
Saginaw (Saginaw)	65.89	17.53	16.26	32.15	5.88	51.12	14.01	19.00
Macomb (Mt. Clemens)	66.75	21.54	17.89	32.81	7.00	60.09	14.22	16.40
Marquette (Marquette)	68.97	24.26	23.61	23.30	6.66	50.40	14.26	29.05
Bay (Bay City)	66.10	19.09	14.72	30.37	6.75	56.99	14.69	19.94

7.8 Tracer Regressions

7.8.1 Dependent Variables

Four variants of physician expenditures or use were analyzed for each of the three tracers: charges per beneficiary by service, charges per service, services per beneficiary, and a composite total charges per beneficiary for all services. Eight different services were analyzed, each derived through aggregation of Medicare Type-of-Service Codes as follows (the TOS codes correspond to carrier "type of service").

(1) HOSPITAL including

TOS 1: surgery or emergency treatment
TOS 2: surgical assistance
TOS 4: anesthesia
TOS G, H, and I: initial inpatient day with complete history, limited history or subsequent visits

(2) X-RAY, including

TOS 5 and 6: diagnostic and therapeutic X-rays

(3) Office and Home Visits, Physical Therapy, Chiropractic and Dialysis: TOS C

(4) Special Studies (e.g., ECGs): TOS 7

(5) Laboratory Tests: TOS 8

(6) SNF Visits: TOS 0

(7) Consultations: TOS 9

(8) Miscellaneous, including

TOS B = ambulance
TOS D = injections
TOS F = supplies.

All charge variants were deflated by the market area cost-of-living index for 1980.

7.8.2 Independent Variables

A limited set of independent variables was included along with physician supply to control for health status, economic, and medical care differences across market areas. To account for idiosyncratic differences in patient health status within tracer, each enrollee's health status index (BENEHSI) was included as a covariate. If status varies systematically across market areas, this should control for it, leaving

any residual variation to be explained by other factors. As a higher index score implies poorer health, BENEHSI should be positively associated with charges and utilization.

Two demand-side variables reflecting economic status were also included: per capita income, COL-adjusted (ADJPCI); and percent of Medicare enrollees with supplemental coverage (PCTCOMP). Medicare provides extensive insurance coverage for all medical services, with the exception of nursing home care, rendering economic status less important than if patients paid for everything out-of-pocket. Nevertheless, enrollees must meet a deductible and a copay, and are responsible for any charges above the Medicare allowable if the physician refuses assignment. Over half of Michigan enrollees have purchased Blue Shield supplementary insurance to protect themselves against such costs. Areas with greater supplementary coverage should exhibit greater economic demand by beneficiaries given this protection. Wealthier enrollees should also be able to afford more care, ceteris paribus. Area per capita income is not necessarily indicative of the income status of the elderly, but should be a factor for the population at large. Elderly living in higher income areas should face higher charges for this reason. They may also receive more intensive care as well if their treatment patterns are similar to their higher income neighbors.

Two supply-side variables were used to reflect hospital bed availability (BED/EPOP) and local area labor costs (ADJBILL). Many physician services are complementary with hospital care; hence the more plentiful are hospital beds, the more likely physician utilization and charges will be higher. BED/EPOP is measured as the number of hospital beds per 100 population in the market area. High input costs should discourage physician supply, or alternatively raise the charge associated with physician services requiring auxiliary personnel.

As part of this project, we surveyed all physicians in Michigan and received 2,000 responses on the costs associated with various kinds of support personnel (e.g., secretaries, RNs). These responses were aggregated to the market area, then COL-deflated to produce a relative, adjusted cost of labor (ADJBILL).

Finally, two measures of physician supply were used to test for demand inducement: primary care physicians per effective population (PC/EPOP); and other patient care physicians per effective population (OMD/EPOP). If physicians compete by encouraging patients to utilize more of their services, this should be reflected in positive coefficients for one or both of these variables. Effective population is used as a denominator to adjust for patient bordercrossing among market areas. In markets with net patient immigration for care, physicians per "effective population" will be lower, reflecting their greater scarcity.

7.8.3 Estimation Methods

All regressions were estimated using Ordinary Least Squares on a single cross-section of beneficiaries for care received in 1980. Sample sizes ranged between 5,600 and 13,400 for the three tracers, depending on the dependent variable. All regressions were specified in linear form.

The dependent variable and health status were measured at the beneficiary level; the rest of the explanatory variables at the level of the market area. One can think of this specification as an n-way analysis of variance without interactions. Mean charge and utilization rates across market areas are being statistically compared, holding other demand-supply variables constant.

7.8.4 Multivariate Regression Results

Tables 7-12 to 7-14 present the regression results for the three tracers. Each table includes 26 regressions, first, for total charges and utilization (frequency) per beneficiary, then for eight services (e.g., inpatient, office visit). T-statistics are provided next to the regression coefficients; R^2s and F-statistics (in parentheses) are at the bottom of each regression. Coefficients for charges can be read in dollars or price while those for frequency are in services per beneficiary.

The pattern of results is fairly consistent across the three tracers. As expected, our index of health status is by far the best explainer of variations in charges and utilization (t-statistics were usually in excess of 20). Even still, the R^2s rarely exceeded 10 percent, implying that most of the variation remained idiosyncratic to the patient.

Physician Supply

The two physician supply variables also showed a fairly consistent pattern overall, although a number of minor differences emerge. In general, the availability of primary care physicians (i.e., GPs, FPs, general surgeons, OB-GYNs, and pediatricians) appears to add to charges and utilization while other specialties together either have no effect or lower utilization and total charges. Using the PC/EPOP coefficients from the total charge equation as an example, market areas with "more" physicians per capita (with more defined as one standard deviation = .209) add the following to total costs:

Diabetes:	\$ 65.84	(= \$315 x .209)
Hypertension:	\$111.19	(= \$532 x .209)
UTI:	\$165.95	(= \$794 x .209)

Table 7-12

DIABETES REGRESSIONS

Total	Charges Per Beneficiary Coeff	T	Frequency Coeff	T	Charges Per Service Coeff	T
INTERCEPT	-407.927	-3.3	-21.205	-4.3		
BENEHSI	718.206	30.3	27.111	28.7		
ADJPCI	0.067	3.3	0.004	5.3		
PCTCOMP	-180.166	-1.2	6.816	1.2		
OMD/EPOP	-25.292	-0.2	-3.658	-0.7		
PC/EPOP	314.503	1.8	16.908	2.4		
BED/EPOP	128.236	1.1	10.325	2.2		
ADJBILL	-60.177	-2.8	-5.522	-6.5		
	$R^2=$ 0.08 (157)		$R^2=$ 0.10 (189)			

Inpatient	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-35.117	-0.4	-3.851	-1.8	73.049	4.1
BENEHSI	387.841	23.9	10.147	25.5	-4.307	-1.3
ADJPCI	0.002	0.1	0.0006	2.0	-0.002	-0.9
PCTCOMP	-141.109	-1.4	-7.257	-3.0	20.782	1.0
OMD/EPOP	29.840	0.3	-3.086	-1.5	22.613	1.3
PC/EPOP	48.775	0.4	5.819	2.0	-36.066	-1.4
BED/EPOP	28.879	0.3	3.842	1.9	-20.706	-1.2
ADJBILL	-1.129	-0.07	-0.467	-1.3	4.782	1.5
	$R^2=$ 0.05 (83)		$R^2=$ 0.05 (95)		$R^2=$ 0.001 (1)	

Office Visits	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-15.680	-0.9	-0.068	0.05	12.969	19.2
BENEHSI	35.609	11.2	2.469	10.2	0.498	3.7
ADJPCI	0.008	3.1	0.0004	2.2	-0.00003	-0.3
PCTCOMP	-50.418	-2.6	-2.191	-1.5	-0.527	-0.6
OMD/EPOP	42.784	2.6	2.582	2.1	2.800	4.2
PC/EPOP	-7.300	-0.3	-1.235	-0.7	0.269	0.2
BED/EPOP	46.278	2.9	2.538	2.1	0.415	0.6
ADJBILL	-6.353	-2.2	-0.370	-1.7	-0.063	-0.5
	$R^2=$ 0.03 (51)		$R^2=$ 0.02 (31)		$R^2=$ 0.03 (53)	

Table 7-12 (Cont'd)

DIABETES REGRESSIONS

X-ray	Charges Per Beneficiary Coeff	T	Frequency Coeff	T	Charges Per Service Coeff	T
INTERCEPT	-54.107	-3.0	-2.338	-3.4	23.407	9.5
BENEHSI	70.545	20.1	3.346	25.3	-1.522	-3.3
ADJPCI	0.010	3.5	0.0003	3.4	-0.0001	-0.4
PCTCOMP	-34.656	-1.6	-1.310	-1.6	4.426	1.5
OMD/EPOP	-33.203	-1.8	-1.765	-2.6	7.440	3.0
PC/EPOP	82.254	3.2	3.313	3.4	-5.025	-1.4
BED/EPOP	-3.946	-0.2	0.095	0.1	-6.082	-2.5
ADJBILL	-7.590	-2.4	-0.177	-1.5	-0.195	-0.4
	$R^2=$ 0.04 (75)		$R^2=$ 0.05 (102)		$R^2=$ 0.01 (16)	

Special Studies	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-74.603	-5.6	-2.103	-6.5	20.473	4.3
BENEHSI	62.621	24.2	1.906	30.3	2.544	3.1
ADJPCI	0.006	3.0	0.0001	3.0	0.001	1.6
PCTCOMP	68.775	4.4	1.747	4.6	3.890	0.7
OMD/EPOP	-26.800	-2.0	-0.774	-2.4	-3.201	-0.7
PC/EPOP	73.374	3.9	1.864	4.1	8.873	1.4
BED/EPOP	-38.923	-3.0	-1.055	-3.4	0.345	0.08
ADJBILL	-8.518	-3.7	-0.138	-2.4	-2.378	-3.0
	$R^2=$ 0.08 (156)		$R^2=$ 0.10 (202)		$R^2=$ 0.01 (10)	

Lab	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-92.962	-5.2	-7.467	-3.3	4.215	12.2
BENEHSI	39.824	11.4	4.974	11.4	0.384	5.7
ADJPCI	0.017	6.0	0.001	3.9	0.0002	4.3
PCTCOMP	66.976	3.2	17.757	6.7	-1.144	-2.8
OMD/EPOP	-1.562	-0.08	1.515	0.6	-0.859	-2.5
PC/EPOP	60.495	2.4	3.579	1.1	2.443	5.1
BED/EPOP	38.598	2.2	2.771	1.2	-0.488	-1.5
ADJBILL	-27.649	-8.9	-3.374	-8.7	0.018	0.3
	$R^2=$ 0.07 (141)		$R^2=$ 0.07 (146)		$R^2=$ 0.02 (37)	

Table 7-12 (Cont'd)

DIABETES REGRESSIONS

Nursing Homes	Charges Per Beneficiary Coeff	T	Frequency Coeff	T	Charges Per Service Coeff	T
INTERCEPT	-35.257	-2.5	-1.003	-2.2	-9.114	-0.5
BENEHSI	10.387	3.8	0.465	5.2	3.108	0.9
ADJPCI	0.006	2.6	0.0002	2.7	0.005	1.9
PCTCOMP	32.439	-1.9	-0.681	-1.2	-41.087	-2.0
OMD/EPOP	-1.418	-0.1	0.621	1.3	-31.614	-1.9
PC/EPOP	14.818	0.7	-0.411	-0.6	52.516	2.2
BED/EPOP	29.174	2.1	0.784	1.8	17.228	1.0
ADJBILL	-1.243	-0.5	-0.030	-0.3	-1.158	-0.3
	$R^2=$ 0.004 (8)		$R^2=$ 0.01 (16)		$R^2=$ 0.003 (1)	

Consults	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-24.609	-3.1	-0.294	-2.2	39.321	13.2
BENEHSI	31.305	21.1	0.531	21.0	1.898	3.5
ADJPCI	0.002	1.8	0.00002	1.2	0.001	3.3
PCTCOMP	-5.416	-0.6	-0.097	-0.6	4.711	1.3
OMD/EPOP	1.153	0.1	0.074	0.5	-4.879	-1.6
PC/EPOP	15.813	1.4	0.148	0.8	13.025	3.1
BED/EPOP	6.988	0.9	0.066	0.5	6.735	2.2
ADJBILL	-2.705	-2.0	-0.030	-1.3	-1.959	-3.7
	$R^2=$ 0.04 (80)		$R^2=$ 0.04 (74)		$R^2=$ 0.08 (34)	

Misc. (Inc. Amb.)	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-76.251	-2.0	-4.216	-2.9	51.713	5.6
BENEHSI	80.076	11.2	3.270	11.8	2.825	1.6
ADJPCI	0.013	2.1	0.0008	3.6	-0.005	-3.6
PCTCOMP	-51.961	-1.2	-1.150	-0.6	5.582	0.5
OMD/EPOP	-36.089	-1.0	-2.825	-2.0	29.010	3.1
PC/EPOP	26.259	0.5	3.829	1.9	-40.278	-3.1
BED/EPOP	24.351	0.6	1.285	0.9	-10.117	-1.1
ADJBILL	-5.574	-0.8	-0.934	-3.8	5.923	3.6
	$R^2=$ 0.01 (19)		$R^2=$ 0.01 (28)		$R^2=$ 0.01 (7)	

Table 7-13

HYPERTENSION REGRESSIONS

Total	Charges Per Beneficiary Coeff	T	Frequency Coeff	T	Charges Per Service Coeff	T
INTERCEPT	-321.906	-3.2	-23.163	-5.9		
BENEHSI	638.286	34.8	23.926	33.6		
ADJPCI	0.049	3.1	0.003	6.0		
PCTCOMP	38.996	0.3	11.490	2.5		
OMD/EPOP	-169.658	-1.7	-11.066	-2.9		
PC/EPOP	532.127	3.7	26.328	4.8		
BED/EPOP	-100.016	-0.9	5.465	1.3		
ADJBILL	-39.154	-2.1	-3.561	-5.0		
	R^2= 0.10 (217)		R^2= 0.12 (268)			

Inpatient	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-40.251	-0.5	-3.746	-2.3	104.469	5.3
BENEHSI	341.042	26.4	8.803	30.5	-6.543	-1.9
ADJPCI	0.008	0.7	0.0007	2.8	-0.005	-1.7
PCTCOMP	-113.405	-1.4	-6.518	-3.6	15.218	0.6
OMD/EPOP	-88.556	-1.3	-4.611	-3.0	23.535	1.2
PC/EPOP	249.049	2.5	9.290	4.2	-38.373	-1.4
BED/EPOP	-86.687	-1.1	-0.326	-0.2	-23.127	-1.1
ADJBILL	1.706	0.1	-0.281	-0.9	7.995	2.2
	R^2= 0.05 (105)		R^2= 0.06 (140)		R^2= 0.002 (2)	

Office Visits	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	3.345	0.2	0.400	0.3	15.436	25.4
BENEHSI	28.569	10.7	1.748	9.0	0.467	4.1
ADJPCI	0.008	3.5	0.0007	4.3	-0.0004	-5.1
PCTCOMP	-32.804	-1.9	-2.744	-2.2	2.206	3.1
OMD/EPOP	0.224	0.01	-1.448	-1.4	3.939	6.7
PC/EPOP	48.693	2.3	3.827	2.5	-1.281	-1.5
BED/EPOP	21.998	1.4	1.859	1.7	-2.067	-3.3
ADJBILL	-3.972	-1.5	-0.317	-1.6	0.259	2.3
	R^2= 0.02 (49)		R^2= 0.01 (29)		R^2= 0.03 (54)	

Table 7-13 (Cont'd)

HYPERTENSION REGRESSIONS

X-ray	Charges Per Beneficiary Coeff	T	Frequency Coeff	T	Charges Per Service Coeff	T
INTERCEPT	-32.477	-2.1	-2.026	-3.4	27.393	11.4
BENEHSI	61.462	22.4	2.888	26.6	-0.959	-2.2
ADJPCI	0.010	4.2	0.0004	5.1	-0.0007	-1.9
PCTCOMP	-38.720	-2.2	-1.993	-2.9	5.740	2.1
OMD/EPOP	-32.346	-2.2	-2.450	-4.2	9.139	4.0
PC/EPOP	70.178	3.3	4.133	4.9	-8.225	-2.4
BED/EPOP	-24.860	-1.6	-0.318	-0.5	-9.165	-3.6
ADJBILL	-6.619	-2.4	-0.225	-2.3	0.232	0.5
	$R^2=$ 0.05 (105)		$R^2=$ 0.05 (118)		$R^2=$ 0.009 (12)	

Special Studies	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-41.811	-3.6	-1.074	-3.6	27.029	6.7
BENEHSI	55.037	25.9	1.695	31.6	2.016	3.0
ADJPCI	0.003	2.0	0.00005	1.2	0.0006	1.0
PCTCOMP	81.601	6.1	2.156	6.4	5.901	1.2
OMD/EPOP	-24.913	-2.2	-0.665	-2.3	-2.019	-0.5
PC/EPOP	63.094	3.8	1.670	4.0	8.467	1.5
BED/EPOP	-55.838	-4.6	-1.621	-5.3	5.571	-1.3
ADJBILL	-8.701	-4.1	-0.113	-2.1	-2.536	-3.4
	$R^2=$ 0.08 (181)		$R^2=$ 0.10 (223)		$R^2=$ 0.01 (13)	

Lab	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-105.014	-7.3	-10.657	-5.9	4.144	9.1
BENEHSI	37.429	14.3	5.002	15.2	-0.067	-0.8
ADJPCI	0.012	5.3	0.0008	2.9	0.0004	6.3
PCTCOMP	100.770	6.1	20.394	9.9	-1.575	-3.0
OMD/EPOP	-15.875	-1.1	0.074	0.04	-1.817	-4.1
PC/EPOP	67.571	3.3	3.878	1.5	3.333	-5.4
BED/EPOP	41.838	2.8	3.610	1.9	0.229	0.5
ADJBILL	-17.424	-6.7	-1.937	-5.9	-0.157	-1.9
	$R^2=$ 0.08 (183)		$R^2=$ 0.08 (188)		$R^2=$ 0.01 (24)	

Table 7-13 (Cont'd)

HYPERTENSION REGRESSIONS

Nursing Homes	Charges Per Beneficiary Coeff	T	Frequency Coeff	T	Charges Per Service Coeff	T
INTERCEPT	-27.279	-2.0	-1.323	-3.8	7.961	0.6
BENEHSI	12.202	4.9	0.507	8.0	8.210	3.7
ADJPCI	0.002	1.3	0.0001	3.0	0.0001	0.07
PCTCOMP	-5.37	-0.3	-0.086	-0.2	-2.154	-0.14
OMD/EPOP	-5.41	-0.4	0.229	0.6	-12.452	-1.02
PC/EPOP	21.280	1.1	0.040	0.08	14.680	0.8
BED/EPOP	8.045	0.5	0.434	1.2	-10.059	-0.7
ADJBILL	0.851	0.3	0.032	0.5	2.510	1.0
	R^2= 0.004 (8)		R^2= 0.01 (28)		R^2= 0.004 (2)	

Consults	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-17.439	2.6	-0.203	-1.74	41.429	13.2
BENEHSI	30.663	25.2	0.525	24.5	3.288	6.3
ADJPCI	0.002	2.3	0.00003	1.8	0.001	2.5
PCTCOMP	-10.420	-1.3	-0.165	-1.2	1.216	0.3
OMD/EPOP	-6.761	-1.0	-0.104	-0.9	-4.386	-1.4
PC/EPOP	27.857	2.9	0.409	2.4	15.769	3.5
BED/EPOP	-7.702	-1.1	-0.195	-1.6	4.463	1.3
ADJBILL	-3.072	-2.5	-0.045	-2.1	-1.873	-3.2
	R^2= 0.05 (113)		R^2= 0.04 (100)		R^2= 0.08 (35)	

Misc (Inc. Amb.)	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-60.969	-2.1	-4.533	-3.7	37.275	4.3
BENEHSI	71.875	13.8	2.754	12.5	4.470	3.0
ADJPCI	0.001	0.4	0.0006	3.5	-0.003	-2.3
PCTCOMP	57.597	1.7	0.450	0.3	-1.359	-0.1
OMD/EPOP	4.168	0.1	-2.088	-1.8	16.658	2.0
PC/EPOP	-15.825	-0.3	3.075	1.8	-20.463	-1.7
BED/EPOP	3.307	0.1	2.025	1.6	-10.699	-1.2
ADJBILL	-1.885	-0.3	-0.642	-2.9	3.541	2.2
	R^2= 0.01 (31)		R^2= 0.01 (36)		R^2= 0.005(4)	

Table 7-14

URINARY TRACT INFECTION REGRESSIONS

Total	Charges Per Beneficiary Coeff	T	Frequency Coeff	T	Charges Per Service Coeff	T
INTERCEPT	-573.815	-2.7	-38.115	-4.0		
BENEHSI	884.516	18.9	33.172	15.4		
ADJPCI	0.082	2.3	0.005	3.5		
PCTCOMP	-175.229	-0.7	10.855	1.0		
OMD/EPOP	-213.609	-1.1	-17.787	-2.1		
PC/EPOP	793.623	3.1	44.969	3.8		
BED/EPOP	240.895	1.2	19.157	2.1		
ADJBILL	-76.683	-2.2	-6.034	-3.8		
	$R^2=$ 0.08 (75)		$R^2=$ 0.08 (77)			

Inpatient	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-36.700	-0.2	-6.104	-1.7	107.786	4.9
BENEHSI	476.055	15.2	11.217	14.0	3.440	0.7
ADJPCI	0.001	0.07	0.001	2.4	-0.007	-1.9
PCTCOMP	-148.377	-0.9	-11.902	-3.0	22.247	0.9
OMD/EPOP	16.254	0.1	-4.076	-1.2	13.571	0.7
PC/EPOP	145.965	0.8	7.549	1.7	-4.341	-0.1
BED/EPOP	28.743	0.2	6.163	1.8	-50.498	-2.4
ADJBILL	1.280	.05	-1.279	-2.1	7.460	2.0
	$R^2=$ 0.04 (35)		$R^2=$ 0.03 (31)		$R^2=$ 0.002 (1.35)	

Office Visits	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-30.681	-0.8	-0.623	-0.2	12.536	12.5
BENEHSI	42.670	5.3	3.273	5.0	0.454	1.9
ADJPCI	0.011	1.8	0.0004	0.8	0.0001	1.1
PCTCOMP	-30.696	-0.7	1.927	0.6	-2.386	-2.1
OMD/EPOP	-3.739	-0.1	0.510	0.2	0.463	0.5
PC/EPOP	74.202	1.7	2.242	0.6	3.377	2.7
BED/EPOP	65.631	2.0	3.535	1.3	-0.224	-0.2
ADJBILL	-11.395	-1.9	0.647	-1.3	0.019	0.1
	$R^2=$ 0.02 (18)		$R^2=$ 0.01 (10)		$R^2=$ 0.03 (24)	

URINARY TRACT INFECTION REGRESSIONS

X-ray	Charges Per Beneficiary Coeff	T	Frequency Coeff	T	Charges Per Service Coeff	T
INTERCEPT	-114.523	-3.1	-3.774	-2.7	19.281	5.7
BENEHSI	101.222	12.3	4.446	14.4	-1.642	-2.2
ADJPCI	0.015	2.4	0.0007	3.0	-0.0006	-1.0
PCTCOMP	-42.979	-1.0	-2.771	-1.8	8.645	2.3
OMD/EPOP	-97.222	-3.0	-4.492	-3.6	4.257	1.4
PC/EPOP	214.749	4.8	8.337	5.0	2.463	0.5
BED/EPOP	43.112	1.2	1.391	1.1	-4.213	-1.3
ADJBILL	-11.726	-1.9	-0.648	-2.8	1.502	2.6
	$R^2=$ 0.04 (38)		$R^2=$ 0.04 (42)		$R^2=$ 0.02 (14)	

Special Studies	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-83.387	-3.5	-1.678	-3.0	19.344	2.8
BENEHSI	78.729	14.8	2.318	18.6	1.638	1.2
ADJPCI	0.007	1.8	0.0001	1.362	0.001	1.4
PCTCOMP	52.717	2.0	1.532	2.5	-3.295	-0.4
OMD/EPOP	-39.037	-1.8	-1.227	-2.5	0.452	0.07
PC/EPOP	110.447	3.8	3.210	4.7	6.641	0.8
BED/EPOP	-31.586	-1.4	-1.738	-3.4	11.044	1.8
ADJBILL	-12.052	-3.0	-0.198	-2.1	-3.367	-2.9
	$R^2=$ 0.07 (68)		$R^2=$ 0.10 (91)		$R^2=$ 0.01 (7)	

Lab	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-140.336	-3.7	-14.368	-3.5	6.007	9.9
BENEHSI	38.944	4.6	4.740	5.2	0.474	3.5
ADJPCI	0.019	3.0	0.001	2.7	-0.0001	-1.0
PCTCOMP	90.214	2.2	17.245	3.9	1.297	2.0
OMD/EPOP	-57.333	-1.7	-6.825	-1.9	1.137	2.1
PC/EPOP	183.894	4.0	21.069	4.2	-0.053	-0.07
BED/EPOP	59.522	1.7	4.098	1.1	0.118	0.21
ADJBILL	-22.325	-3.6	-2.321	-3.4	-0.110	-1.0
	$R^2=$ 0.06 (54)		$R^2=$ 0.07 (69)		$R^2=$ 0.02 (17)	

Table 7-14 (Cont'd)

HYPERTENSION REGRESSIONS

Nursing Homes	Charges Per Beneficiary Coeff	T	Frequency Coeff	T	Charges Per Service Coeff	T
INTERCEPT	-71.184	-3.9	-3.487	-4.5	13.824	0.8
BENEHSI	24.721	6.0	0.815	4.7	7.942	2.3
ADJPCI	0.007	2.3	0.0004	3.1	0.0006	0.2
PCTCOMP	-43.606	-2.1	-5.04	-1.8	-28.657	-1.5
OMD/EPOP	-20.312	-1.2	-0.315	-0.4	-14.130	-0.9
PC/EPOP	42.495	1.9	0.161	0.1	37.232	1.9
BED/EPOP	55.842	3.3	3.63	5.1	-10.127	-0.6
ADJBILL	1.739	0.5	-0.024	-0.1	2.928	1.0
	$R^2=$ 0.01 (11)		$R^2=$ 0.01 (11)		$R^2=$ 0.009 (2)	

Consults	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-25.239	-1.6	-0.290	-1.1	38.967	9.9
BENEHSI	39.495	11.6	0.651	11.4	2.266	2.6
ADJPCI	0.005	2.1	0.00007	1.7	0.002	4.0
PCTCOMP	-24.180	-1.4	-0.336	-1.2	-7.548	-1.6
OMD/EPOP	-8.614	-0.6	-0.073	-0.3	-8.066	-2.2
PC/EPOP	41.945	2.2	0.500	1.6	20.395	4.0
BED/EPOP	2.006	0.1	-0.012	-0.05	6.457	1.7
ADJBILL	-7.411	-2.9	-0.100	-2.4	-3.151	-4.5
	$R^2=$ 0.04 (33)		$R^2=$ 0.03 (28)		$R^2=$ 0.09 (25)	

Misc. (Inc. Amb.)	Coeff	T	Coeff	T	Coeff	T
INTERCEPT	-74.121	-1.3	-7.811	-2.4	26.691	1.8
BENEHSI	82.404	6.6	5.705	7.9	-0.072	-0.02
ADJPCI	0.014	1.6	0.0005	1.0	0.002	1.1
PCTCOMP	-29.580	-0.4	6.654	1.9	-55.378	-3.5
OMD/EPOP	-5.794	-0.1	-1.308	-0.4	-9.921	-0.7
PC/EPOP	-18.230	-0.2	1.915	0.4	10.977	0.6
BED/EPOP	19.358	0.3	2.102	0.7	1.318	0.1
ADJBILL	-15.200	-1.6	-0.817	-1.5	1.210	0.4
	$R^2=$ 0.01 (8)		$R^2=$ 0.01 (16)		$R^2=$ 0.01 (4)	

Table 7-15 summarizes the signs and statistical significance of the two physician-availability measures for all the regressions. Nine cost categories are analyzed, with two lines per category: PC, primary care physicians; OMC, other medical care. The columns headed by the $ symbol give coefficients for total charges per beneficiary as the dependent variable while the F and $/F columns report physician-availability coefficients on total frequency per beneficiary and charge per service, respectively. Asterisks give statistical significance.

The following points are evident from the table. First, practically all of the primary care coefficients are either positive or insignificant. Concentrating on the $ column, the PC coefficient is uniformly positive and significant across all three tracers for four categories: total charges per beneficiary, x-rays, special studies, and lab work. The PC coefficient is also positive in two of three tracers for two additional services: office visits and consultations. The only services where a consistent, positive primary care effect was not found was for inpatient services, SNFs, and miscellaneous.

Second, with the exception of lab work, the positive impact of primary care availability comes from increased frequency and not higher prices. Consider special studies as an example. The PC/EPOP coefficients for diabetes and hypertension are 1.9 and 1.7, respectively; for UTI, it is 3.2. One standard deviation above the PC/EPOP mean (=.209) would imply .4, .36, and .67 more special exams per beneficiary per year in plentiful primary care market areas. Again, this is partially offset by negative coefficients for other specialties. It should be kept in mind that we are working with specific tracer conditions with a further adjustment for each patient's health status--as proxied by age, sex, and complicating diagnoses.

Third, there is very little evidence that greater physician availability results in lower charges, or prices, per service. Negative price effects were found only in a few instances, none for the major services like inpatient and office services. One interesting result is the coefficients for consultations. They imply that more primary care physicians raise both consultation rates and fees while the availability of other specialties may lower fees, only for UTI patients, not total but charges on consultations.

Note, also, that total office visits per diabetic beneficiary are uniformly higher in specialist-dominated areas. This probably reflects more extensive referrals to specialists where they are more plentiful.

Table 7-15

Signs and Statistical Significance of Regression
Coefficients For Primary Care (PC) and Other Medical Care (OMC) Availability

Expenditure Category		Diabetes			Hypertension			UTI		
		$	F	$/F	$	F	$/F	$	F	$/F
Total	--PC	+*	+**		+**	+**		+**	+**	
	--OMC				-*	-**			-**	
Inpatient	--PC		+**		+**	+**			+*	
	--OMC					-**				
Office	--PC				+**	+**		+*		+**
	--OMC	+**	+**	+**			+**			
X-Ray	--PC	+**	+**		+**	+**	-**	+**	+**	
	--OMC	-*	-**	+**	-**	-**	+**	-**	-**	
Special Studies	--PC	+**	+**		+**	+**		+**	+**	
	--OMC	-**	-**		-**	-**		-*	-**	
Lab	--PC	+**		+**	+**		-**	+**	+**	
	--OMC			-**			-**	-*	-*	+**
SNFs	--PC			+**				+*		+*
	--OMC			-*						
Consults	--PC			+*	+**	+**	+**	+**		+**
	--OMC									-**
Misc.	--PC		+*	-**		+*	-*			
	--OMC		-**	+**		-*	+**			

KEY: $ = total charges per beneficiary
F = number of procedures per beneficiary
$/F = charge per unit of service
* = coefficient significant at 10% level
** = coefficient significant at 5% level

Income and Insurance

Real per capita income in a market area uniformly raised total charges and utilization per beneficiary across the tracers. While income of the entire population does not necessarily reflect that of the Medicare population, we hypothesize that practice norms are established within areas based on the general ability to pay. Medicare beneficiaries, therefore, who live in wealthier areas see physicians who practice more intensively in accord with these norms. Note that income effects are also quite uniform across service, adding significantly to service intensity for hospital, office, and ancillary care.

The Medigap insurance variable, on the other hand, produced few significant findings. We had expected both charges and utilization per beneficiary to be greater in areas where Blue Shield had sold more supplemental coverage to the elderly. Except for hypertension services, this hypothesis was not supported in toto. A very consistent pattern of offsetting effects by service category explain this result. For inpatient physician care, office visits, and x-rays, PCTCOMP shows a negative association with frequency; in other words, the greater the percentage of Medicare beneficiaries with supplementary Blue Shield coverage, the lower is their average hospital, office and x-ray use of physician services, ceteris paribus. This offsets the higher frequency of special study and lab services. Reinhardt (1978) has argued that these services have a large discretionary component and are particularly amenable to inducement because they involve little or no direct physician input. Such is not the case with hospital and office surgical and medical visits.

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THE IMPACT OF PHYSICIAN SUPPLY AND REGULATION
ON PHYSICIAN FEES AND UTILIZATION OF SERVICES

APPENDICES

THE IMPACT OF PHYSICIAN SUPPLY AND REGULATION ON PHYSICIAN FEES AND UTILIZATION OF SERVICES

BOOK II

APPENDICES

APPENDIX A

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APPENDIX A

QUALITY DECISIONS IN A MARKET CLEARING MODEL

Key features of Hirshleifer's (1980, pp. 376-380) analysis of equilibrium quality in a competitive industry are both reviewed and extended here in order to develop conclusions appropriate to the particular quality related issues relevant to our work. This approach defines a product's quality in terms of its attribute(s) content (Z) (e.g., life of a lightbulb or length of a physician visit). With fully informed consumers, the price of any product is proportional to Z, its attribute content. Their demand function is also redefined as a demand for the attribute. Questions of interest include the equilibrium attribute price (P_A); the quality decisions of producers; and the effects on these phenomena of exogenous changes in supply.

The equilibrium attribute price is determined from aggregate attribute demand (D_A^1) and supply (S_A^1) functions as shown below in Figure A-1. Note that the vertical axis measure the unit attribute price (e.g., one hour of light from a 100 watt bulb) and the horizontal axis represents the aggregate attribute output (e.g., billions of hours). Points on the supply curve show the aggregate attribute production at any attribute price and are defined by

$$\sum_{i=1}^{n} Z_i Q_i$$

where Q_i is the combined output of all producers of the ith product

quality and Z_i is the corresponding attribute content. In Figure A-1, P_A^1 and Q_A^1 are the equilibrium attribute price and total attribute output, respectively.

The optimal product quality and total attribute output selected by any firm are determined by the attribute's market price and the cost functions associated with producing the attribute(s) through different product qualities. For example, Figure A-2 shows the average and marginal cost curves of producing the attribute through two different product qualities say, Z_1 and Z_2 (e.g., lightbulbs that last 1,000 and 2,000 hours, respectively). At price P_A, the firm maximizes profits by selecting quality level 2 (in this case, the higher quality) and producing an attribute quantity q_A^1. The number of lightbulbs is equal to q_A^1 divided by Z_2 (e.g., 2,000) and their price is $P_A^1 Z_2$. If price were P_A^2, the firm would maximize profits with quality 1 and an attribute output level of q_A^2. Although in this example, the higher quality level has higher cost curves for the attribute, there is no general relationship between product quality and unit attribute costs (e.g., the average or marginal costs of producing an hour of light through different product qualities). The product with the higher quality will, of course, cost more to produce because it contains more of the attribute.

Quality differences among producers at the equilibrium price arise from variations among firms in their respective cost functions (e.g., from skill differences among physicians). Because firms are not identical, cost curves vary and some may find it more profitable to select quality 1 at price P_A or some other quality level that the firm in Figure A-2 is not capable of producing.

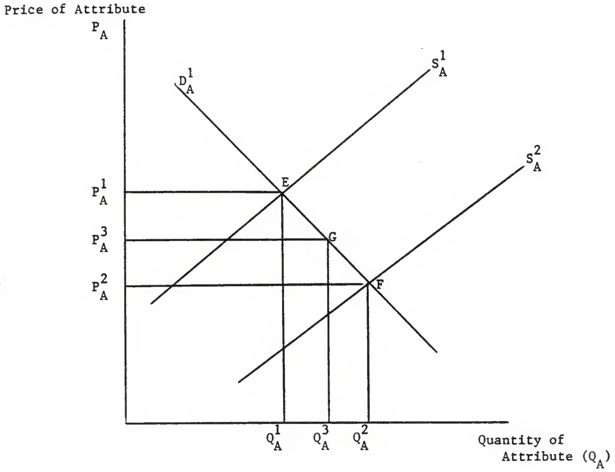

Figure A.1

Aggregate Attribute Quantity and Attribute Market Price

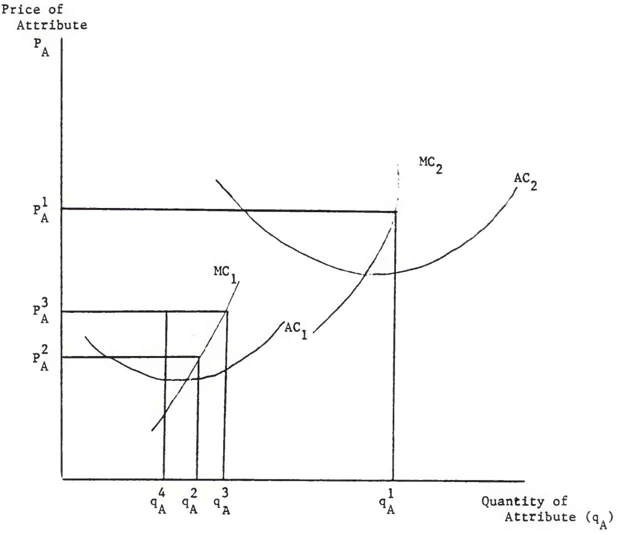

Figure A.2

Individual Firm Attribute Decisions

More significant, however, for our analysis are the effects on firm choices and market outcomes of an increase in the number of providers. Clearly an increase in supply to S_A^2 in Figure A.1 reduces the equilibrium attribute price to P_A^2 and increases output to Q_A^2. If all producers leave quality levels unchanged, then the standard competitive predictions of a lower price and greater quantity of (quality unadjusted) output follow. Some, or all firms, though may alter quality as indicated by the quality change shown in Figure A.2. Without specific information on production functions, however, there is no way of determining whether increases in supply will result in higher or lower average quality levels. The cost curves associated with producing quality level 1 in Figure A.2 could in general represent a product with a lower or higher attribute content than product quality 2. Thus, the typical firm could raise or reduce quality as the attribute price declines and any combination of changes in quality unadjusted price total output could follow an increase in supply (i.e., quality unadjusted price and output could each go up or down so that four outcomes are possible). Quality adjusted price, however, must fall and aggregate (or per capita) quality adjusted output must increase.

Another useful set of conclusions relevant to the proposed models in Chapter 2 deals with the effects of price rigidities on the adjustment process. Suppose there is downward price rigidity in the quality unadjusted price (e.g., the price of a 100-watt lightbulb). If at P_A^2, in the absence of rigidities, there would be no quality levels selected by any firm which would result in lower quality unadjusted prices that it was charging initially at P_A^1, then the transition from the market equilibrium at E to the new equilibrium at F in Figure A.1 could still proceed smoothly. That is, even in the absence of price rigidities, the

market price of lightbulbs would not have been lower--quality would have been improved to reduce the attribute price which is just what takes place with price rigidities.

If, however, the optimal decisions of some firms at P_A^2 would result in quality levels which correspond to lower product prices than those set at the original equilibrium (through a quality level which would, with an attribute price P_A^2, result in a lower product price than those firms had initially charged), then the movement to the new equilibrium cannot be completed. In the absence of demand inducement, the attribute price falls along D_A in Figure A.1 to a point such as G which falls short of the competitive equilibrium at F. In terms of Figure A.2, assume that quality level corresponding to cost curve 1 together with an attribute price P_A^2 defines a product price (i.e., lightbulbs) which is lower than previously charged by the firm. This could not happen under the assumption of downward product price rigidity and the attribute price falls only to P_A^3. Suppose at this price the firm in Figure A.2 still optimizes by producing output with quality 1. To maximize profit, it wants to produce an attribute output of q_A^3. But demand is insufficient as seen from Figure A.1 because the attribute price is too high and the firm sells only q_A^4. A gap between its desired production level and actual output level is created by the price rigidity. If demand inducement is possible, an incentive for inducement is created and actual aggregate output at P_A^3 in Figure A.1 may exceed C.

DEMAND SHIFTS: THE SIMPLE MONOPOLY CASE

In a standard monopoly model without amenities or inducement, the profit function can be expressed as:

$$\pi = QP(Q;E) - C(Q)$$

where E represents a shift parameter. The first order condition for profit maximization is:

$$F = \frac{d\pi}{dQ} = P + Q\,\frac{\partial P}{\partial Q} - \frac{\partial C}{\partial Q} = 0$$

which reduces to the familiar equality between marginal revenue and marginal cost. The effects on the equilibrium price ($\bar{P}$) and quantity ($\bar{Q}$) of an increase in demand (resulting from, say, a decrease in the physician-population ratio) is easily derived from the implicit function theorem so that:

$$\frac{d\bar{Q}}{dE} = -\frac{F_E}{F_Q} = -\frac{\frac{\partial P}{\partial E}}{2\frac{\partial P}{\partial Q} + Q\frac{\partial^2 P}{\partial Q^2} - \frac{\partial^2 C}{\partial Q^2}}$$

But, from the second order condition for profit maximization, $\frac{d^2\pi}{dQ^2}\,(=F_Q) < 0$. Thus, $\frac{d\bar{Q}}{dE} > 0$, since $F_E > 0$. Similarly, it can be shown that $\frac{d\bar{P}}{dE} > 0$.

AMENITIES AND INDUCEMENT IN A MONOPOLY PROFIT MAXIMIZING MODEL

Consider the monopolist's profit function defined in section 2.4.2 in Chapter 2 as:

$$\pi = PQ(P,Z;R) - C(Q(P,Z;R),Z) \tag{1}$$

The first order conditions for maximization are

$$\frac{\partial \pi}{\partial P} = \pi_p = P\frac{\partial Q}{\partial P} + Q - \frac{\partial C}{\partial Q}\frac{\partial Q}{\partial P} = 0 \tag{2}$$

and

$$\frac{\partial \pi}{\partial Z} = \pi_z = P\frac{\partial Q}{\partial Z} - \frac{\partial C}{\partial Q}\frac{\partial Q}{\partial Z} - \frac{\partial C}{\partial Z} = 0 \tag{3}$$

Equation (2) can be rewritten as:

$$P + Q\frac{\partial P}{\partial Q} = \frac{\partial C}{\partial Q}$$

which states that holding quality constant, marginal revenue must equal marginal cost. From equation (3),

$$P\frac{\partial Q}{\partial Z} = \frac{\partial C}{\partial Q}\frac{\partial Q}{\partial Z} + \frac{\partial C}{\partial Z}$$

which requires that holding price constant, the marginal revenue associated with the additional output produced by an incremental unit of Z equals the sum of the production costs of the additional output and the cost of

increasing Z. A discussion and graphical representation of a firm in equilibrium is found in Section 2.5.2 in Chapter 2.

To determine the effects of changes in the population-physician ratio on the equilibrium values of P and Z, differentiate totally equations (2) and (3) with respect to P, Z, and R. From equation (2),

$$d\pi_P = P\frac{\partial^2 Q}{\partial P^2}\,dP + P\frac{\partial^2 Q}{\partial P\partial Z}\,dZ + P\frac{\partial^2 Q}{\partial P\partial R}\,dR + \frac{\partial Q}{\partial P}\,dP + \frac{\partial Q}{\partial P} + \frac{\partial Q}{\partial Z}\,dZ$$

$$+ \frac{\partial Q}{\partial R}\,dR - \frac{\partial Q}{\partial P}\left[\frac{\partial^2 C}{\partial Q^2}\left(\frac{\partial Q}{\partial P}\,dP + \frac{\partial Q}{\partial Z}\,dZ + \frac{\partial Q}{\partial R}\,dR\right) + \frac{\partial^2 Q}{\partial Q\partial Z}\,dZ\right]$$

$$- \frac{\partial C}{\partial Q}\left[\frac{\partial^2 Q}{\partial P^2}\,dP + \frac{\partial^2 Q}{\partial P\partial Z}\,dZ - \frac{\partial^2 Q}{\partial P\partial R}\,dR\right]$$

$$= 0 = \pi_{PP}\,dP + \pi_{PZ}\,dZ + \pi_{PR}\,dR \qquad (4)$$

where

$$\pi_{PP} = \frac{\partial^2 Q}{\partial P^2}\left(P - \frac{\partial C}{\partial Q}\right) + \frac{\partial Q}{\partial P}\left(2 - \frac{\partial Q}{\partial P}\frac{\partial^2 C}{\partial Q^2}\right)$$

< 0 if second order conditions are satisfied

$$\pi_{PR} = \frac{\partial^2 Q}{\partial P\partial R}\left(P - \frac{\partial C}{\partial Q}\right) + \frac{\partial Q}{\partial Z} - \frac{\partial Q}{\partial P}\left(\frac{\partial Q}{\partial Z}\frac{\partial^2 C}{\partial Q^2} + \frac{\partial^2 C}{\partial Q\partial Z}\right)$$

> 0 with the Wisniewski, et al. (1980, Appendix J) assumptions

$$\pi_{PR} = \frac{\partial^2 Q}{\partial P\partial R}\left(P - \frac{\partial C}{\partial Q}\right) + \frac{\partial Q}{\partial R}\left(1 - \frac{\partial Q}{\partial P}\frac{\partial^2 C}{\partial Q^2}\right)$$

> 0 if following Wisniewski, et al., Q_{PR} is assumed to be positive.

From equation (3),

$$d\pi_Z = P\,\frac{\partial^2 Q}{\partial P \partial Z}\,dP + P\,\frac{\partial^2 Q}{\partial Z^2}\,dZ + P\,\frac{\partial^2 Q}{\partial Z \partial R}\,dR + \frac{\partial Q}{\partial Z}\,dP$$

$$- \frac{\partial C}{\partial Q}\left[\frac{\partial^2 Q}{\partial Z\ P}\,dP + \frac{\partial^2 Q}{\partial Z^2}\,dZ + \frac{\partial^2 Q}{\partial Z \partial R}\,dR\right]$$

$$- \frac{\partial Q}{\partial Z}\left[\frac{\partial^2 C}{\partial Q^2}\left(\frac{\partial Q}{\partial P}\,dP + \frac{\partial Q}{\partial Z}\,dZ + \frac{\partial Q}{\partial R}\,dR\right) + \frac{\partial^2 C}{\partial Z^2}\,dZ\right]$$

$$- \frac{\partial^2 C}{\partial Z \partial P}\,dP - \frac{\partial^2 C}{\partial Z^2}\,dZ - \frac{\partial^2 C}{\partial Z \partial R}\,dR$$

$$= 0 = \pi_{ZP}\,dP + \pi_{ZZ}\,dZ + \pi_{ZR}\,dR \qquad (5)$$

where

$$\pi_{ZP} = \frac{\partial^2 Q}{\partial Z \partial P}\left(P - \frac{\partial C}{\partial Q}\right) + \frac{\partial Q}{\partial Z} - \frac{\partial Q}{\partial Z}\,\frac{\partial^2 C}{\partial Q^2}\,\frac{\partial Q}{\partial P} - \frac{\partial^2 C}{\partial Z \partial P}$$

> 0 if both Q_{ZP} and C_{ZP} are assumed positive (Wisniewski, et al.);

$$\pi_{ZZ} = \frac{\partial^2 Q}{\partial Z^2}\left(P - \frac{\partial C}{\partial Q}\right) - \frac{\partial Q}{\partial Z}\left(\frac{\partial^2 C}{\partial Q^2}\,\frac{\partial Q}{\partial Z} + \frac{\partial^2 C}{\partial Z^2}\right) - \frac{\partial^2 C}{\partial Z^2}$$

< 0 assuming the conditions for a maximum are attained

$$\pi_{ZR} = \frac{\partial^2 Q}{\partial Z \partial R}\left(P - \frac{\partial C}{\partial Q}\right) - \frac{\partial Q}{\partial Z}\,\frac{\partial^2 C}{\partial Q^2}\,\frac{\partial Q}{\partial R} - \frac{\partial^2 C}{\partial Z \partial R}$$

< 0 assuming $C_{ZR} > 0$ and, following Wisniewski, et al., $Q_{ZR} < 0$.

Rewriting equations (4) and (5) in matrix form as

$$\begin{bmatrix} \pi_{PP} & \pi_{PZ} \\ \pi_{ZP} & \pi_{ZZ} \end{bmatrix} \begin{bmatrix} \frac{dP}{dR} \\ \frac{dZ}{dR} \end{bmatrix} = - \begin{bmatrix} \pi_{PR} \\ \pi_{ZR} \end{bmatrix}$$

and applying Cramer's rule

$$\frac{dP}{dR} = \frac{-\overset{-}{\pi}_{ZZ}\ \overset{+}{\pi}_{PR} + \overset{+}{\pi}_{PZ}\ \overset{-}{\pi}_{ZR}}{|A|} = ?$$

and

$$\frac{dZ}{dR} = \frac{-\overset{-}{\pi}_{PP}\ \overset{-}{\pi}_{ZR} + \overset{+}{\pi}_{PR}\ \overset{+}{\pi}_{ZP}}{|A|} = ?$$

where

$$|A| = \overset{-}{\pi}_{PP}\ \overset{-}{\pi}_{ZZ} - \overset{+}{\pi}_{PP}\ \overset{+}{\pi}_{ZP} = ?$$

Thus, even after accepting certain arbitrary assumptions necessary to sign several of the π terms, neither the numerator or denominator terms of either equation can be signed and thus the effects of shifts in demand on the equilibrium values of the endogenous variables are indeterminate.

INDUCEMENT IN A MODEL WITH PRICE RIGIDITIES: UTILITY MAXIMIZATION

The grant proposal (pp. 31-37) included an elaborate geometric exposition of individual physician behavior when fees are rigid and where the physician has an Evans-Reinhardt extended utility function. This section provides formal mathematical solutions as well as a simplified geometric interpretation for a slightly modified model in which inducement is more precisely defined than before. The comparative static properties of this variant, however, are identical to those given in the proposal and are also consistent with the results derived from the preferred profit maximizing with inducement cost model shown in Appendix E.

Assume a utility function

$$U = U(Y, L, D) \tag{1}$$

where Y and L represent net income and leisure hours, respectively. Unlike previous analyses where D is vaguely defined as "physician's discretionary influence on patient demand" (Sloan and Feldman (1978, p. 49)), here it represents hours of providing induced output as defined by the difference between physician output (in hours) and the output (in hours) that would be demanded by patients were they fully informed or that the physician perceives would be demanded by fully informed patients.

The variable D can be positive, zero, or negative where latter values correspond to fully informed demand which, because the physician is contacted by more patients than he would prefer, is not completely met (i.e., there is excess demand which is not satisfied). It is commonly assumed that $\frac{\partial U}{\partial U}$ is negative for all nonzero values of D and equal to zero when D is zero. The second order partial derivative is everywhere negative.

Increases in the numerical values of D are not symmetric in the positive and negative regions. In both cases there is an increase in disutility in either providing induced services or not providing services which would be "demanded." In the former case, however, there is an income gain and a leisure loss, while in the latter case there is a leisure gain and income loss. (Here there are no other costs of the kind suggested in section two and included in the profit maximizing model associated with attempts by the physician to induce changes in demand.)

There is only one decision variable in this model--the optimal value of D, or alternatively, the optimum number of hours of work. (A serious defect with this approach, and one of the reasons we have selected a profit maximizing alternative, is its failure to distinguish between inputs and output and the impression created that they are identical.) Before determining the equilibrium conditions, some additional definitions and relationships are needed. Let

T = total time available

W = total hours of work

R = population-physician ratio

P = hourly fee = $\bar{P}$

$h(P)$ = demand relationship of representative fully informed consumer (= $\bar{h}$ with a fixed fee)

Also,

$$L = T - W \tag{2}$$

$$W = R\bar{h} + D \tag{3}$$

$$Y = PW \text{ (assuming, for simplicity, no other costs)} \tag{4}$$

$$dY = \bar{P}\ dW = \bar{P}(\bar{h}dR + dD) \tag{5}$$

$$dL = -\ dW = -\ \bar{h}dR - dD \tag{6}$$

To determine the first order condition for utility maximization, substitute equations (2) - (4) into (1) and differentiate with respect to W or D. Thus, letting subscripts indicate partial derivatives

$$V = \frac{\partial U}{\partial W} = \frac{\partial U}{\partial W} = \bar{P}U_Y - U_L + U_D = 0 \tag{7}$$

Equation (7) represents the familiar condition that inducement should continue to the point where the marginal disutility from doing so plus the marginal disutility of leisure foregone (gained in the negative range) equals the marginal utility derived (lost in the negative range) from the income generated (lost) from the last unit of inducement. To illustrate, Figure A.3 shows aggregated market demand and supply schedules where the former continues to represent the demands of consumers were they fully informed and the latter is an aggregation of individual supply curves derived for price takers in the usual way (i.e., the quantity of labor supplied at any price by a utility maximizer if he were free to select any number of hours without resorting to inducement). The equilibrium market price is $\bar{P}_1$.

If the fixed fee were $\bar{P}_1$, the typical physician in Figure A.4 (which shows an individual supply curve) would have just the right number of

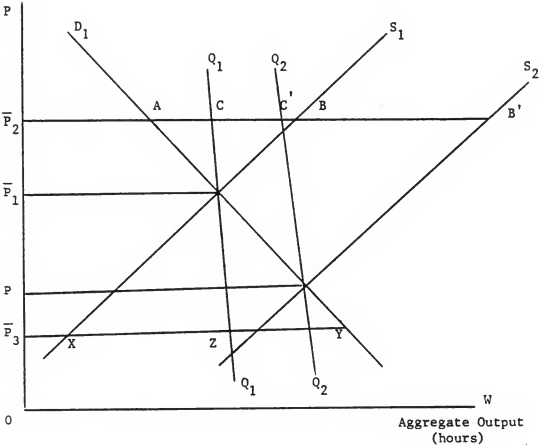

Figure A.3

Aggregate Demand, Supply and Output

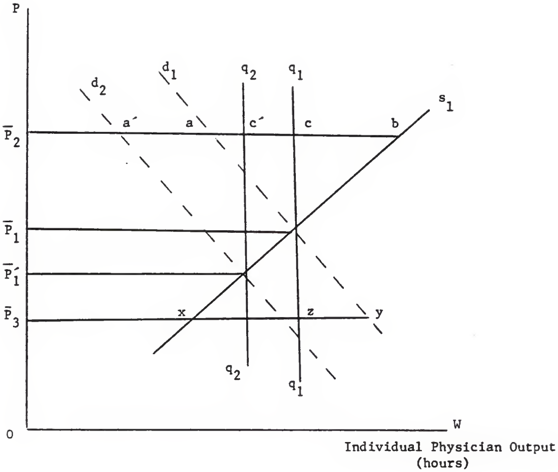

Figure A.4

Individual Firm Output Decisions

patients such that he would be on his individual supply curve when he provides patients with their fully informed level of services. There is no inducement at equilibrium because desired quantities supplied are exactly equal to desired demands.

On the other hand at $\bar{P}_2 > \bar{P}_1$, there is excess supply in the sense that fully informed demand falls short, at this price, of the aggregate quantity physicians want to provide. In other words, the individual physician finds that the assumption of an infinitely elastic demand at $\bar{P}_2$ is incorrect and that the patient load is insufficient without inducement to provide the desired output at b. (The broken curve d_1 which shows the actual quantities demanded by the physician's patients when all physicians face the same market price is proportional to the market demand schedule D_1.) This gap between desired supply and quantity demanded provides the incentive for inducement with the equilibrium level defined from equation (7). Given the disutility associated with D, output will not reach b, but will be somewhere between a and b at a point such as c, with ac representing the amount of induced output.

If fees were below the market clearing level $\bar{P}_1$ (e.g., at $\bar{P}_3$), there is an excess demand for the physician's services. This would result in negative values of inducement such as yz in Figure A.4. Thus q_1q_1 would represent the output of the physician at any market price given the demand and supply conditions shown in Figure A.3. The analogous aggregated output schedule Q_1Q_1 is shown in Figure A.3 with the difference at any fee between output and demand representing the level of inducement.

To determine how output and inducement vary with the population-physician ratio, set the total differential of equation (7) equal to zero. Thus

$$dV = \bar{P}U_{YY}dY + \bar{P}U_{YL}dL + \bar{P}U_{YD}dD - U_{LY}dY - U_{LL}dL$$

$$- U_{LD}dD + U_{DY}dY + U_{DL}dL + U_{DD}dD$$

$$= 0$$

Substituting (5) and (6) into this expression

$$dV = \bar{P}^2U_{YY}\bar{h}dR + \bar{P}^2U_{YY}dD - \bar{P}U_{YL}\bar{h}dR - \bar{P}U_{YL}dD + \bar{P}U_{YD}dD$$

$$- \bar{P}U_{YL}\bar{h}dr - \bar{P}U_{LY}dD + U_{LL}\bar{h}dR + U_{LL}dD - U_{LD}dD$$

$$+ PU_{DY}\bar{h}dR + PU_{DY}dD - U_{DL}\bar{h}dR - U_{DL}dD + U_{DD}dD$$

$$= 0 = \bar{h}dR\left[\bar{P}^2U_{YY} - 2\bar{P}U_{YL} + U_{LL} + \bar{P}U_{DY} - U_{DL}\right]$$

$$+ dD\left\{\left[\bar{P}^2U_{YY} - 2\bar{P}U_{YL} + U_{LL} + \bar{P}U_{DY} - U_{DL}\right] + \left[\bar{P}U_{DY} + U_{DD} - U_{DL}\right]\right\}$$

$$= 0$$

Thus $dD[F + G] = - \bar{h}dr[F]$ where F and G represent the corresponding bracketed terms above. Or

$$\frac{dD}{dR} = - \frac{\bar{h}F}{F + G} \qquad (8)$$

With the assumptions that U_{YY}, U_{LL}, and U_{DD} are each negative and adopting the assumptions found in footnote 4 of the more detailed unpublished version of Sloan and Feldman (1978) that U_{YD} is negative and U_{YL} and U_{LD} are both positive, thus $F < 0$ and $G < 0$ and therefore $\frac{dD}{dR} < 0$. In other words an increase (decrease) in the physician-population ratio increases (decreases) induced output. In addition, because $F/(F + G) < 1$ a one

patient decrease (increase) in demand ($\bar{h}$) decreases (increases) individual physician workloads and incomes because the change in D < $\bar{h}$. Of course the increase (decrease) in physicians will increase (decrease) aggregate output because the aggregate level of D increases (decreases).

To illustrate, suppose that in Figure A.3 fees are at $\bar{P}_2$ and there is an increase in supply to S_2. The typical physician's patient load and quantity demanded decrease from a to a' in Figure A.4 and the gap between quantity demanded and desired output increases. The comparative static properties of the model indicate that the level of output c' will be such that the induced amount a'c' will exceed the former level and that the fall in output cc' will be less than aa', the physician's decrease in demand at P_2. In aggregated terms, total induced output increases from AC to AC' in Figure A.3, although the total increase in output CC is less than BB' the increase in supply at $\bar{P}_2$.

INDUCEMENT IN A MODEL WITH PRICE RIGIDITIES AND INDUCEMENT COSTS: PROFIT MAXIMIZATION

With a fixed fee, maximize

$$\pi = \bar{P} \bullet Q(Z;R) - C(Q(Z;R),Z)$$

where Z represents inducement effort and R is the population-physician ratio. Differentiating with respect to Z and setting the resulting expression equal to zero determines the first order condition.

$$\frac{d\pi}{dZ} = \bar{P}\,\frac{\partial Q(\cdot)}{\partial Z} - \frac{\partial C(\cdot)}{\partial Q(\cdot)}\,\frac{\partial Q(\cdot)}{\partial Z} - \frac{\partial C(\cdot)}{\partial Z} = 0$$

This states that the marginal revenue associated with an additional unit of inducement must equal the sum of the marginal production costs and inducement costs.

To determine the effects on Z of changes in R, differentiate totally with respect to Z and R.

$$d\pi_Z = \bar{P}\,\frac{\partial^2 Q}{\partial Z^2}\,dZ + \bar{P}\,\frac{\partial^2 Q}{\partial Z \partial R}\,dR - \frac{\partial C}{\partial Q}\left[\frac{\partial^2 Q}{\partial_Z^2}\,dZ + \frac{\partial^2 Q}{\partial Z \partial R}\,dR\right]$$

$$- \frac{\partial Q}{\partial Z}\left[\frac{\partial^2 C}{\partial Q^2}\left(\frac{\partial Q}{\partial Z}\,dZ + \frac{\partial Q}{\partial R}\,dR\right) + \frac{\partial^2 C}{\partial Z^2}\,dZ\right] - \frac{\partial^2 C}{\partial Z^2}\,dZ - \frac{\partial^2 C}{\partial Z \partial R}\,dR$$

$$= \Pi_{ZZ}dZ + \Pi_{ZR}dR = 0$$

where

$$\pi_{ZZ} = \frac{\partial^2 Q}{\partial Z^2} (\bar{P} - \frac{\partial C}{\partial Q}) - \frac{\partial Q}{\partial Z} \frac{\partial^2 C}{\partial Q^2} \frac{\partial Q}{\partial Z} - \frac{\partial^2 C}{\partial Z^2} (\frac{\partial Q}{\partial Z} + 1)$$

and must be negative for profit maximization, and

$$\Pi_{ZR} = \overset{-}{\frac{\partial^2 Q}{\partial Z \partial R}} \cdot \overset{+}{(P - \frac{\partial C}{\partial Q})} - \overset{+}{\frac{\partial Q}{\partial Z}} \overset{+}{\frac{\partial^2 C}{\partial Q^2}} \overset{+}{\frac{\partial Q}{\partial R}} - \overset{+}{\frac{\partial^2 C}{\partial Z \partial R}}$$

which, from the signs shown above each expression, is also negative.

Thus

$$\frac{dZ}{dR} = - \frac{\pi_{ZR}}{\pi_{ZZ}} < 0$$

An increase in the population-physician ratio (decrease in the physician-population ratio) reduces (increases) inducement.

APPENDIX B

TABLE OF CONTENTS

APPENDIX B

DESCRIPTION OF PROCEDURES USED IN THE CREATION OF MARKET BASKETS

The attached list of procedure codes describes the 424 procedures and the 14 market baskets which have been formed. (The study, however, concentrates on four market baskets: total surgery, total medical care, total maternity and the 424 total procedures.) Along with each procedure code, we indicate the market basket(s) where the procedure was placed.

Market Basket	Type of Procedures	Number of Procedures in Market Basket
A	Low cost surgery	19
B	High cost surgery	10
C	Maternity	2
D	Medical Care	3
S	Total surgery	340
MC	Total medical care	40
OB	Total maternity	13
E	Anesthesia	4
F	Consultation	3
G	Pathology	8
H	Professional comp. x-ray	8
K	Diagnosis x-ray	6
L	Psychiatry	2
GT	Total procedures	424

MEDICINE

OFFICE OR OUTPATIENT VISITS

ESTABLISHED PATIENT

9020 Brief service (MC)

9025 Limited examination, evaluation and treatment (usual follow-up visit) (MC)

9026 Intermediate examination, evaluation and treatment (MC)

9027 Comprehensive examination, evaluation and treatment (MC)

HOSPITAL OR REHABILITATION VISITS

NEW OR ESTABLISHED PATIENT

9070 Initial hospital care, limited history and physical examination, (D,MC) including initiation of diagnostic and treatment program and preparation of hospital records

9071 Initial hospital care, comprehensive history and physical examination, including initiation of diagnostic and treatment program and preparation of hospital records (D,MC)

9072 with intensive medical care

9075 Subsequent hospital care, per day (specify number) (D,MC)

#9077 Prolonged constant attendance, per hour (specify number) MC

9078 Intensive medical care, subsequent days, per day (specify number) MC

+9081 Initial examination of newborn MC

EMERGENCY SERVICE (MEDICAL ONLY)

NEW OR ESTABLISHED PATIENT

9120 Medical emergency MC

CONSULTATIONS

9150 Consultation requiring limited examination and evaluation of a (F) given system with report

9151 Consultation requiring extensive examination and evaluation, but (F) not requiring comprehensive history and examination with report

9153 Consultation requiring comprehensive history and examination and/or (F) evaluation with report

PSYCHIATRIC SERVICES

9170 Psychotherapy, verbal, drug augmented or other methods, 50 minutes (L)

9171 25 minutes (L)

CARDIOVASCULAR

9370 Electrocardiogram, with interpretation and report (MC)

9372 interpretation and report only MC

9374 with exercise test, with interpretation and report (MC)

9377 single lead (for rhythm) with interpretation MC

9381 Computer tracing and interpretation of ECG's MC

9382 Physician interpretation of computer ECG tracing MC

9383 Phonocardiogram with interpretation and report (MC)

9384 with indirect carotid artery tracing or similar study MC

9394 Electrocardiogram with graded exercise test, including supervision, MC interpretation and report (treadmill)

9379 MC

9397 MC

PULMONARY

9450 Spirometry, complete, including graphic record, total and timed vital MC capacity and maximal breathing capacity, with written report

9454 Bronchospasm evaluation: spirometry as in 9450, before and after MC bronchodilator (aerosol or parenteral)

9456 total and timed (forced expiratory volumes) MC

9461 Maximal expiratory flow rate measurement or equivalent MC

MISCELLANEOUS

9533 Electroencephalogram (EEG), awake, asleep (natural or induced) and activation (MC)

9534 interpretation and report only MC

9538 Electromyography, extremity only, each (specify number) MC

9542 Electromyography, one extremity and related paraspinal area MC

9543 two extremities and related paraspinal areas MC

9545 Nerve conduction velocity study, motor or sensory, each nerve (specify number) MC

9547 motor and sensory, each nerve (specify number) MC

9550 Nerve conduction velocity study, additional ipsilateral or contralateral nerve, each (specify number) MC

SPECIFIC THERAPEUTIC PROCEDURES

Miscellaneous

9566 infusion (continuous or intermittent) MC

CHEMOTHERAPEUTIC DRUGS

9736 Cytoxan (Cyclophosphamide) MC

9740 5-Fluorouracil MC

9745 Methotrexate MC

9750 Oncovin-Vincristin MC

RADIOLOGY-RADIOGRAPHIC EXAMINATIONS

X-RAY DIAGNOSTIC

HEAD AND NECK

7060 complete study, minimum of four views, with or without stereo (H,K) (skull), (5 & P)

CHEST

7101 single view (P & 5) (H,K)

7102 two views or stereo (P & 5) (H,K)

LOWER EXTREMITIES

7311 complete study, minimum three views (P & 5) (H,K)

GASTROINTESTINAL TRACT

7337 Gastrointestinal tract, upper, with or without delayed films, (H,K) without KUB, including fluoroscopy (P & 5)

7582 Computerized axial tomography, head, without intravenous contrast (H,K) (ABU:3) (P & 5)

7583 with intravenous contrast (ABU:3) (P & 5)

7584 without intravenous contrast, followed by intravenous contrast (ABU:3) (P & 5)

HEMATOLOGY

8361	**Blood count, manual (includes rbc, wbc, hgb, hct or pcv, with or without indices, with or without differential)**	(G)
8001		(G)
8020		(G)

URINE CHEMISTRY AND TOXICOLOGY

8700 Urinalysis, routine, complete (includes physical appearance, pH, specific gravity, microscopic examination, and qualitative chemistry with or without semi-quantitative confirmation) (G)

NOTE: When any three or more of the procedures 8701, 8702, 8703, 8710, 8712, 8730, 8761, 8863, 8865, 8873 and 8874 are performed, the procedures must be billed as procedure code 8700.

MICROBIOLOGY

8891 Susceptibility (sensitivity) for aerobes by Kirby-Bauer procedure for specific pathogens, using 10-12 discs per pathogen; also for susceptibility (sensitivity) for anaerobes by generally accepted standard technics, using 5-12 discs per pathogen (specify number of pathogens) (G)

INTEGUMENTARY SYSTEM

Skin, Mucous Membrane, Subcutaneous and Areolar Tissues

INCISION

0001	Emergency first aid (surgical) (treatment of minor injuries)	(A,S)
0003	Incision and drainage of abscess, simple	(A,S)
0004	complicated	(A,S)
0006	Incision and drainage of infected or non-infected sebaceous cyst, furuncle or steatoma, one lesion	(S)
0007	two lesions	(S)
0008	over two, each additional lesion (specify number)	(S)
0015	Incision and drainage of pilonidal cyst, simple	(S)
0017	Incision and drainage of onychia or paronychia, single	(S)
0018	multiple	(S)
0020	Incision and removal of foreign body, subcutaneous tissues, simple	(S)
0021	complicated	(S)
0022	Incision and drainage of hematoma, simple	(S)
0023	complicated	(S)
0025	Puncture aspiration of abscess or hematoma	(S)

EXCISION

0040	Debridement of extensively eczematous or infected skin up to five square inches (32.3 square cm) of the body surface	(S)
0043	Debridement of abrasions	(S)

0060	Biopsy; excision of skin, subcutaneous tissue or mucous membrane (including simple closure), unless otherwise listed	(S)
0071	Excision of single fibrocutaneous tag, any area	(S)
0072	multiple	(S)
	OTHER BENIGN LESIONS (Unless Separately Listed Elsewhere)	
	Trunk, Arms Or Legs:	
0090	lesion diameter up to 1/4 inch (0.6 cm) ..	(S)
0091	lesion diameter 1/4 to 1/2 inch (0.7 cm to 1.2 cm)	(S)
0092	lesion diameter 1/2 to 3/4 inch (1.3 cm to 1.8 cm)	(S)
	Scalp, Neck, Hands, Feet Or Genitalia:	
0095	lesion diameter up to 1/4 inch (0.6 cm) ..	(A,S)
0096	lesion diameter 1/4 to 1/2 inch (0.7 cm to 1.2 cm)	(A,S)
0097	lesion diameter 1/2 to 3/4 inch (1.3 cm to 1.8 cm)	(A,S)
	Face, Ears, Eyelids, Nose, Lips Or Mucous Membrane:	
0100	lesion diameter up to 1/4 inch (0.6 cm) ..	(S)
0101	lesion diameter 1/4 to 1/2 inch (0.7 cm to 1.2 cm)	(S)
0102	lesion diameter 1/2 to 3/4 inch (1.3 cm to 1.8 cm)	(S)
#0108	Lesion diameter greater than 3/4 inch (1.8 cm) or multiple, or complicated, any area	(S)

Face, Ears, Eyelids, Nose, Lips Or Mucous Membrane:

0120	lesion diameter up to 1/4 inch (0.6 cm) ..	(S)
0121	lesion diameter 1/4 to 1/2 inch (0.7 cm to 1.2 cm)	(S)
0122	lesion diameter 1/2 to 3/4 inch (1.3 cm to 1.8 cm)	(S)
#0125	Lesion diameter more than 3/4 inch (1.8 cm), or multiple, or complicated, or unusually located, any area	(S)

OTHER EXCISIONS

0135	Avulsion, nail plate, complete, simple, single	(S)
0140	Excision of nail and nail matrix, for permanent removal, complete, single	(S)
0141	second nail and nail matrix	(S)
0147	Excision complete, plantar vertuea, single site	(S)
0148	multiple site	(S)
0163	Avulsion, nail plate, partial, simple, single	(S)
0164	second nail plate	(S)
0166	Excision of nail and nail matrix, for permanent removal, partial, single	(S)
0167	second nail and nail matrix	(S)

INTRODUCTION

0170	Injection, intralesional (up to and including seven lesions)	(S)
0171	more than seven	(S)

REPAIR

SIMPLE

0180	Up to one inch (2.5 cm), trunk, arms, legs, scalp, neck, hands or feet	(A,S)
0181	face, ear, eyelid, lip, nose, genitalia or mucous membrane	(A,S)
0182	1 inch to 2 inches (2.5 cm to 5.1 cm), trunk, arms or legs	(A,S)
0183	scalp, neck, hands, feet or genitalia	(S)
0184	face, ears, eyelids, nose, lips or mucous membrane	(S)
0185	2 inches to 4 inches (5.1 cm to 10.2 cm), trunk, arms or legs	(S)
0186	scalp, neck, hands, feet or genitalia	(S)
0187	face, ears, eyelids, nose, lips or mucous membrane	(S)

COMPLEX

#0200	Unusual, complicated repair, any area	(S)
0216	Removal of sutures (by other physician)	(S)
0222	forehead, cheeks, chin, mouth, neck, axillae, genitalia, hands and feet	(S)
0223	eyelids, nose, ears and lips	(S)
0227	forehead, cheeks, chin, mouth, neck, axillae, genitalia, hands and feet	(S)
#0230 (T)	more than 3 square inches (19.4 square cm), unusual or complicated, any area	(S)
0280	Split skin graft, up to 16 square inches (103 square cm) (except 0274), trunk, scalp, arms, legs, hands and feet (except multiple digits)	(S)
0375	Abdomen, legs, hips or buttocks	
0376		

BURN CODES

0400	Initial treatment, where no more than local treatment necessary	(S)
0401	Dressing and/or debridement, initial or subsequent, without anesthesia, small (specify number for BCBSM)	(S)
0402	medium (whole face or whole extremity, etc.) (specify number for BCBSM)	(S)
0403	large (specify number for BCBSM)	(S)

DESTRUCTION

0416	Chemocautery, electrosurgical or cryocautery destruction with or without surgical curettement of local lesion, single, any area	(A,S)
0417	up to five	(A,S)
0418	over five	(A,S)

BREAST

INCISION

0450	Puncture aspiration of cyst	(S)

EXCISION

0461	incisional	(S)
0463	Excision of cyst, fibroadenoma or other benign tumor, aberrant breast tissue, duct lesion or nipple lesion (except 0465-0471) unilateral	(S)
0470	Partial mastectomy (quadrectomy or more), unilateral	
0471	bilateral	
0473 (T)	Simple mastectomy, complete, unilateral	
0474 (T)	bilateral	

0475 (T) subcutaneous, unilateral ....

0476 (T) bilateral ....

0483 (T) Radical mastectomy, including pectoral muscles and axillary lymph nodes, unilateral ....

0484 (T) including internal mammary lymph nodes ...

0485 (T) bilateral ....

0486 (T) Modified radical mastectomy, with complete axillary dissection but leaving pectoral muscles, unilateral .... (S)

REPAIR

0492 (T) Mammoplasty, plastic operation on breasts, reduction or repositioning, bilateral, one stage (requires prior approval by Medicaid) ... (S)

MUSCULOSKELETAL SYSTEM

BONES

EXCISION

0520	Biopsy, bone, trochar, superficial (e.g. ilium, sternum, spinous process, ribs, etc.) ..	(S)
#0527	Excisior of tumor of facial bone other than mandible	(S)
0530	Excision of benign cyst or tumor of mandible, simple	(S)

OSTECTOMY

0610	Phalangectomy, single	(S)
0612	Head resection of phalanx	(S)
0613	Hemiphalangectomy or interphalangeal joint excision, single	(S)

PARTIAL OSTECTOMY

0640	Phalangeal base condylectomy, single toe	(S)

PARTIAL EXCISION -- (CRATERIZATION, SAUCERIZATION OR DIAPHYSECTOMY)

0675	phalanx (toe)	(S)

INTRODUCTION OR REMOVAL

0706	Removal of buried wire, pin or screw, superficial	(S)
0707	Deep: buried wire, pin, screw, metal bland, nail, rod or plate	(S)

OSTEOTOMY

0863	Metatarsals, base or shaft, single for shortening or angular correction, first metatarsal, with or without internal fixation .	(S)
0864	other metatarsals, with or without internal fixation	(S)

0865 Proximal phalanx, first toe, for shortening, angular or rotational correction .. (S)

OSTEOPLASTY

0870 (T) Mandible for prognathism or micrognathism (requires prior approval by Medicaid) .... (S)

FRACTURE

REPAIR

SKULL

FACIAL BONE

0897 instrumental, nasal fracture .... (S)

SPINE AND TRUNK

0940 Rib fracture(s) (simple) .... (S)

0983 Clavicular fracture, without reduction .... (S)

0984 closed reduction .... (S)

UPPER EXTREMITY

1041 closed reduction .... (S)

1044 Distal radial fracture (e.g. Colles' type), with or without fracture of ulnar styloid, without reduction .... (S)

1045 closed reduction .... (S)

1065 Metacarpal fracture, single, without reduction .... (S)

1066 closed reduction .... (S)

1075 Phalanges, fracture, proximal or middle finger or thumb, without reduction .... (S)

1076 closed reduction .... (S)

1078	distal phalanx, finger or thumb, without reduction	(S)
	LOWER EXTREMITY	
1142	distal extremity (lateral malleolus), without reduction	(S)
1143	closed reduction	(S)
1146	closed reduction	(S)
1175	Metatarsal(s), fracture(s), without reduction .	(S)
1176	closed reduction	(S)
1180	Phalanx or phalanges, fracture great toe, without reduction	(S)
1185	other than great toe, without reduction	(S)

JOINTS

INCISION

ARTHROTOMY

1207˙(T)	knee	(S)
1213	metatarsophalangeal joint	(S)
1214	interphalangeal joint (toe)	(S)
1226	Metatarsophalangeal joint contracture with or without tenorrhaphy	(S)
1227	Interphalangeal joint, toe, single	(S)
1228	multiple	(S)

INTRODUCTION

1240 Arthrocentesis, aspiration or injection, small joint (e.g. finger, toe, etc.) .... (A,S)

1241 intermediate joint (e.g. temporomandibular, acromioclavicular, wrist, elbow or ankle joint, etc.) .... (A,S)

1242 major joint (e.g. shoulder, hip, knee joint, etc.) .... (A,S)

1244 knee .... (S)

1247 Arthroscopy, knee .... (S)

EXCISION

ARTHRECTOMY

1261 (T) Semilunar cartilage, by arthrotomy .... (S)

1330 (T) acetabular and proximal femoral prosthetic replacement (total hip) .... (S)

1335 (T) total, fascial or prosthetic .... (S)

ARTHRODESIS — SPINAL

1352 (T) anterior interbody approach, with iliac or other autogenous bone graft (includes obtaining graft) .... (S)

PRIMARY OR REPAIR OF PSEUDOARTHROSIS WITHOUT DISCECTOMY

1375 (T) Harrington rod and halo technique for spinal fusion .... (S)

ARTHRODESIS -- OTHER JOINTS

1401 Hammer toe operation, one toe interphalangeal fusion .... (S)

1404 (T) radical exostectomy (Keller, McBride or Mayo type procedure) .... (S)

1405 (T)	with tendon transplants (Joplin type procedure)	(S)
1406 (T)	with metatarsal osteotomy (Mitchell or Lapidus type procedure)	(S)

BURSAE

INCISION

1570	Drainage of infected bursa	(S)

INTRODUCTION

1575	Aspiration and/or injection of bursa, small (finger, toe)	(S)
1576	intermediate (knee, elbow, ankle, wrist) .	(A,S)
1577	large (shoulder, hip)	(A,S)

EXCISION

TENOTOMY -- SUBCUTANEOUS

1681	deep, capsular	(S)
1682	hand or finger	(S)

INTRODUCTION

TENOSYNOVECTOMY

1711	Aspiration of tendon sheath or ganglion	(S)

TENOTOMY -- OPEN

1753	Toe, flexor, single or multiple	(S)
1754	Foot or toe, extensor, single	(S)

BODY & UPPER EXTREMITY

CASTS

1911	Shoulder to hand (long arm)	(S)
1913	Elbow to fingers (short arm)	(S)
1915	Hand and lower forearm (gauntlet)	(S)

LOWER EXTREMITY

CASTS

1944	Long leg cast (thigh to toes)	(S)
1946	walking or ambulatory type	(S)
1948	Cylinder cast (thigh to ankle)	(S)
1950	Short leg (below knee to toes)	(S)
1952	walking or ambulatory type	(S)
1955	Club foot cast with moulding or manipulation, long or short leg, under age 24 months	(S)
1956	bilateral	(S)

STRAPPING

1973	Unna boot	(S)

REMOVAL OR REPAIR

1980	Removal, gauntlet, boot, body, full arm or full leg cast	(S)

RESPIRATORY SYSTEM

NOSE

INCISION

2017 Resection of inferior turbinate (submucous), complete or partial, unilateral or bilateral .. (S)

INTRODUCTION

2020 Injection of turbinates, therapeutic .... (S)

REPAIR

2041 (T) complete, external parts including bony pyramid, lateral and alar cartilages, and/or elevation of nasal tip (requires prior approval by Medicaid) .... (S)

2041 (T) including major septal repair (requires prior approval by Medicaid) .... (S)

2050 Septoplasty .... (S)

2057 Reconstruction, functional, of the internal nose (septal dermatoplasty) .... (S)

DESTRUCTION

2060 Infraction of turbinates, unilateral or bilateral .... (S)

2063 Cauterization of turbinates, superficial, unilateral or bilateral .... (S)

OTHER PROCEDURES

2070 Control of nasal hemorrhage, anterior, unilateral or bilateral, with or without cauterization or anterior packs .... (S)

2072 posterior, with posterior nasal packs, with or without cauterization and/or anterior pack, initial .... (S)

ACCESSORY SINUSES

INCISION

2080	Antrum lavage, puncture or natural ostium, unilateral	(S)
2081	bilateral	(S)
2085	bilateral	(S)

LARYNX

INTRODUCTION

2130	Endotracheal intubation, emergency procedure ..	(S)

ENDOSCOPY

2140	Laryngoscopy, direct, diagnostic	(S)
2148	including excision of tumor and/or stripping of vocal cords or epiglottis ...	(S)

TRACHEA AND BRONCHI

ENDOSCOPY

2180	Bronchoscopy (rigid or fiberoptic instrument), diagnostic	(S)
2181	with biopsy	(S)

LUNGS AND PLEURA

INCISION

2230	Thoracentesis: puncture of pleural cavity for aspiration, initial or subsequent	(S)
2233	Tube thoracostomy with water seal, pneumothorax	(S)

EXCISION

2265 (T) Lobectomy, total, subtotal or segmental .... (S)

CARDIOVASCULAR SYSTEM

REPAIR

2361 (T)	by replacement with bypass, aortic valve .	S
2364 (T)	replacement (with bypass)	S
2367 (T)	Double valve procedure, replacement and/or repair by any of above methods	S
2375 (T)	Coronary artery bypass graft, one artery	S
2376 (T)	two arteries	S
2377 (T)	three arteries	(S)
2378 (T)	four arteries	S
2384 (T)	Repair of ventricular aneurysm with bypass	S
2391 (T)	with bypass atrial septal defect	S
2394 (T)	Repair of ventricular septal defect (with bypass)	S
2419	Not otherwise classified	S
2462	Abdominal Aorta	S

ARTERIES AND VEINS

INCISION

ARTERIAL EMBOLECTOMY

THROMBOENDARTERECTOMY -- WITH OR WITHOUT PATCH GRAFT

2490 (T)	Neck (carotid, vertebral or subclavian)	S

BYPASS GRAFT -- VEIN OR SYNTHETIC GRAFT

2525 (T)	Extremity, unilateral (femoral-popliteal or femoral-femoral)	S

INTRODUCTION

INTRAVENOUS

2560	Needle or intracatheter, unilateral	S
2563	Catheter, by placement in superior or inferior vena cava, right heart or pulmonary artery	(S)

INTRA-ARTERIAL -- INTRA-AORTIC

2570	Needle or intracatheter, carotid or vertebral, unilateral	S
2574	aortic, translumbar	S
2580	Catheter technique, aorta (arch, abdominal, midstream renal, aortoiliac run-off, etc.)	S
2581	cerebral, selective, single artery	S
2583	coronary, selective	S
2584	renal, celiac, mesenteric or other artery, selective, single artery, with or without midstream injection	S

CARDIAC CATHETERIZATION

2590	Cardiac catheterization, including placement of catheter(s), recording of intracardiac and intravascular pressures, obtaining blood samples for measurement of blood gases and/or dye (or other) dilution curves and cardiac output measurements (dye dilution (Fick) or other methods with or without rest and exercise or other studies, with or without chamber injection for angiocardiography, final evaluation and report, right heart only	S
2591	left, percutaneous	S
2593	retrograde	S
2594	combined right and left	S

VENOUS

2600	Venipuncture, complex or non-routine, needle or catheter for diagnostic study or intravenous therapy, percutaneous, under 3 years, femoral, jugular or sagittal sinus	S
2601	scalp vein	S
2616	multiple	S
2620	Central venous pressure catheter placement, subclavian, external jugular or other vein, percutaneous	S

ARTERIAL

2630	Arterial puncture, withdrawal of blood for diagnosis (gas analysis and Ph)	S
2631	Arterial catheterization for monitoring, transfusion or infusion, percutaneous	S

HEMIC AND LYMPHATIC SYSTEMS

SPLEEN

LYMPH NODES AND LYMPHATIC CHANNELS

EXCISION

2790 Biopsy or excision of lymph node .... S

DIGESTIVE SYSTEM

MOUTH

INCISION

2909	Not otherwise classified	S
2955	Frenuloplasty (surgical revision of frenulum, e.g. z-plasty)	S

TEETH AND GUMS

INCISION

2960	Drainage of alveolar abscess with diffuse cellulitis, intraoral	S

EXCISION

2988	Excision of dentigerous cyst (requires prior approval by Medicaid)	S

PHARYNX, ADENOIDS AND TONSILS

EXCISION

3107	Tonsillectomy, with or without adenoidectomy, under 12 years of age	(S)
3108	age 12 or over	(S)
3110	Adenoidectomy	S
3114	with bilateral myringotomy and tube insertion	S

ENDOSCOPY

3160	Esophagoscopy, diagnostic	S

STOMACH

ENDOSCOPY

3220	Gastroscopy, diagnostic	S
3226	Gastroduodenoscopy, with or without esophagoscopy	S
3227	with biopsy	S

INTESTINE -- (EXCEPT RECTUM)

INCIS ON

3250 (T)	Enterolysis (freeing of intestinal adhesions) .	S

EXCISION

3267 (T)	Enteroenterostomy: anastomosis of intestine ..	S
3270 (T)	Colectomy, partial, with anastomosis	(S)
3271 (T)	with coloproctostomy (low pelvic anastomosis)	S
3272 (T)	total, with ileostomy or ileoproctostomy .	S
3273 (T)	with proctectomy and ileostomy	S
3289	Not otherwise classified	S

APPENDIX

EXCISION

3350 (T)	Appendectomy	(S)

RECTUM

EXCISION

3385 (T)	Complete proctectomy, combined abdominoperineal, one or two stages	S

ENDOSCOPY

3400	Sigmoidoscopy, diagnostic, initial	(A,S)
3401	subsequent	(A,S)
3402	with biopsy, initial	S
3404	with removal of papilloma or polyp, initial	S
3407	Colonoscopy (by fiberoptic instrument), descending colon	S
3408	Biopsy with colonscopy (any level), additional	
3410	with insertion of radioactive substance, with or without biopsy or fulguration, initial	S
3414	Polypectomy with colonoscopy (any level), additional	S
3417	Colonoscopy (by fiberoptic instrument), transverse colon	S
3418	Colonoscopy (by fiberoptic instrument), entire colon	S

ANUS

INCISION

3455	Incision and drainage, ischiorectal and/or perirectal abscess	S
3468	Incision of thrombosed hemorrhoid, external	S

EXCISION

3475	Hemorrhoidectomy, external	(B,S)
3476	internal and external	(B,S)
3477	Hemorrhoidectomy, internal, by ligation (Barron technique)	(B,S)

3478	internal plus external including multiple procedures performed at the same time for fissure, fistula, crypts, minor prolapse .	(B)
3479	Hemorrhoidectomy, internal	
3487	Enucleation or excision of external thrombotic hemorrhoids	S

ENDOSCOPY

3510	Anoscopy, diagnostic, with biopsy	S

LIVER

INCISION

3560	Needle biopsy of liver, percutaneous	S

BILIARY TRACT

EXCISION

3620 (T)	Cholecystectomy	(B,E,S)
3621 (T)	with cholangiography	(B,S)
3622 (T)	with open exploration of common duct	(B,S)

ABDOMEN, PERITONEUM AND OMENTUM

INCISION

3690 (T)	Exploratory laparotomy: exploratory celiotomy	S

ENDOSCOPY

3720	Peritoneoscopy (laparoscopy), with or without biopsy	S

HERNIOPLASTY, HERNIORRHAPHY, HERNIOTOMY

REPAIR

3740 (T)	Inguinal, under age 5, unilateral	S
3742 (T)	with excision of hydrocele or spermatocele inguinal	S
3746 (T)	age 5 or over, unilateral	(B,S)
3747 (T)	bilateral	(B,E,S)
3760 (T)	Ventral (or incisional)	S

BLADDER

INTRODUCTION

3990	Injection procedure for cystography	S
3991	Injection procedure for urethrocystography	S
3993	Bladder irri; ition, simple, lavage and/or instillation	S
3996	Cystometrogram	S

REPAIR

4003 (T)	Anterior vesicourethroplasty or urethropexy (i.e. Marshall-Marchetti type)	S

ENDOSCOPY

CYSTOSCOPY, URETHROSCOPY, CYSTOURETHROSCOPY

4020	Diagnostic cystourethroscopy, office	(S)
4021	hospital	(S)
4023	hospital	S
4027	hospital	S
*4029	Urodynamics study (includes codes 9554 - Electromyography, 3996 - Cystometrogram and 4020 - Cystouretroscopy) (for BCBSM, the individual procedure codes must be reported) ..	S

TRANSURETHRAL SURGERY
(URETHRA, PROSTATE, BLADDER, URETER)

4055	with calibration and/or dilation of urethral stricture or stenosis, with or without meatotomy	S
4073 (T)	Transurethral resection of prostate, including control of post-operative bleeding during hospitalization, complete (meatotomy, cystourethroscopy, urethral calibration and/or deviation and internal urethrotomy are included) (electroresection and/or cryosurgery)	(S)

URETHRA

MANIPULATION

4140	Dilation of urethral stricture by passage of sound, male, initial	(S)
4141	subsequent	S
4146	Dilation of female urethra including suppository and/or instillation, initial	S
4147	subsequent	S

PENIS

EXCISION

4170	Circumcision, clamp procedure, newborn (under 3 months)	(S)
4172	surgical excision, other than clamp, newborn (under 3 months)	S
4174	12 or over	S

DESTRUCTION

4220	Condylomata, simple, chemical	S

VAS DEFERENS

EXCISION

4351	Vasectomy, unilateral or bilateral	(S)

VULVA AND INTROITUS

INCISION

4486	Incision and drainage of Bartholin's gland abscess, unilateral	S

DESTRUCTION

4530	Condylomata, simple, chemical	S

CERVIX UTERI

EXCISION

4620	Biopsy or local excision of lesion, with or without fulguration (quadrant) biopsy	S
4621	Cauterization of cervix, electro or thermal ...	S
4622	Circumferential conization, with or without dilation and curettage, with or without sturmdorf type repair	S
4623	Cauterization of cervix, using cryosurgical unit	S
4631	Circumferential conization of cervix, using cryosurgical unit	S

INTRODUCTION

4644	Colposcopy	S
4645	with biopsy	S
4647		S

MANIPULATION

4660	Dilation of cervical canal	S

CORPUS UTERI

EXCISION

4680	Endometrial biopsy, suction type	S
4681	Dilation and curettage, diagnostic and/or therapeutic (non-obstetrical)	(E,S)
4685 (T)	Total hysterectomy (corpus and cervix) with or without tubes, and/or ovaries, and/or dilation and curettage	(B,E,S)
4686 (T)	Supracervical hysterectomy: subtotal hysterectomy, with or without tubes and/or ovaries, one or both	(E)
4696 (T)	with plastic repair of vagina, anterior and/or posterior colporrhaphy	S

INTRODUCTION

4713	Insufflation of uterus and tubes with air and CO_2	S
4715	Injection procedure for hysterosalpingography .	S

OVIDUCT

EXCISION AND REPAIR

4753 (T)	Salpingo-oophorectomy, complete or partial, unilateral or bilateral	S

OVARY

EXCISION

4780 (T)	Excision of ovarian cyst, unilateral or bilateral	S

MATERNITY CARE AND DELIVERY

4800	Amniocentesis for diagnostic purposes (see 8931)	OB
4801	Oxytocin challenge test	OB

INTRODUCTION

4832	Suture incompetent cervix (Sh rodkar or Lash type procedure)	

ANTE PARTUM AND POST PARTUM CARE

4850	Antepartum care only	OB
4851	per visit	OB
4853	Postpartum check-up	OB

CESAREAN SECTION

4860 (T)	Low cervical	(C,OB)
4863 (T)	Classic	OB

ABORTION, SPONTANEOUS

4881	completed surgically	(OB)
4883	completed surgically	OB

ABORTION INDUCED

4890	Therapeutic, by dilation and curettage (including suction curettage)	(OB)
4897	by dilation and curettage (including suction curettage)	OB

ENDOCRINE SYSTEM

THYROID GLAND

EXCISION

4927 (T) **subtotal** .... (S)

NERVOUS SYSTEM

SKULL, MENINGES AND BRAIN

CRANIECTOMY OR BONE FLAP CRANIOTOMY

5059	Not otherwise classified	S

TREPHINE, CRANIECTOMY OR BONE FLAP CRANIOTOMY

EXCISION OR DESTRUCTION

5061 (T)	Excision of brain tumor, abscess or cyst, supratentorial	S

SPINE AND SPINAL CORD

INCISION

#5144 (T)	Laminectomy, more than two segments, for decompression of spinal cord and/or nerve roots, or for spondylolisthesis, any level	S
5155	Spinal puncture, lumbar, diagnostic	(S)
5156	including hydrodynamics	S

EXCISION

5173 (T)	Laminotomy, one or two segments, for herniated intervertebral disc(s) and/or decompression of nerve root(s), cervical or thoracic	S
5176 (T)	lumbar	(S)
5177 (T)	any level, bilateral (specify level)	S

INTRODUCTION

(For injection procedure for pneumoncephalography, see 5090)

5193	Injection procedure for myelography, lumbar ...	S
5194	cervical or thoracic	S
5196	total canal	S

INTRODUCTION

NERVE BLOCK

5282	Greater occipital	S
5286	Intercostal	S
5294	Paravertebral (thoracic, lumbar, sacral, coccygeal), single nerve	S
5296	Sciatic	S
5297	Other peripheral nerve or branch	S
5303	Epidural, caudal or other level	S
5316	Facet injection	S

NEUROLYTIC AGENT

5340	Other peripheral nerve or branch	S

NEUROPLASTY

5377 (T)	median at carpal tunnel	S

EYE

EYEBALL

CORNEA

INCISION

5433	Removal of foreign body from surface	S
5435	Removal of embedded foreign body	S
5436	under slit lamp	S

CRYSTALLINE LENS

EXCISION

5570 (T)	Extraction of lens (intracapsular or extracapsular), with or without iridectomy, unilateral	(S)
5576 (T)	Insertion intraocular lens prosthesis, with cataract extraction, one stage	S

VITREOUS

INTRODUCTION

5585 (T)	posterior (complex) vitrectomy	S

RETINA

REPAIR

5592 (T)	with scleral buckling, scleral resection, encircling tube and/or scleral implant, initial (reattachment)	S
5597	Repair of retinal break(s) or schisis, one or more stages, photocoagulation and/or cryotherapy	S

EXTRAOCULAR MUSCLES

5621 (T) two muscles, one or both eyes (muscle surgery) .... S

ORBIT

INTRODUCTION

5660 Retrobulbar injection, therapeutic agents (priscoline, procaine, etc.) .... S

EYELIDS

EXCISION

5680 Excision of meibomian gland (chalazion), single .... S

5699 Not otherwise classified .... S

CONJUNCTIVA

INCISION

5700 Removal of surface foreign body .... S

LACRIMAL TRACT

MANIPULATION

5782 Probing of nasolacrimal duct, with or without irrigation .... S

EAR

EXTERNAL EAR

ENDOSCOPY

5830	Otoscopy with removal of foreign body (excluding cerumen) in external auditory canal	S

MIDDLE EAR

INCISION

5870	Myringotomy, with or without eustachian tube inflation and with or without aspiration, unilateral	S
5871	bilateral	S
5873	bilateral	S
5926	Tympanoplasty without mastoidectomy, Type I or partial, with or without graft	
5927	Type II, III, IV, with or without graft ..	S
5930	Tympanoplasty with mastoidectomy	S
5876	Myringotomy and evacuation of middle ear Contents....................................	S
5877	bilateral....................................	S

APPENDIX C

PROCEDURES AND BLUE SHIELD-MEDICARE

CONVERSION CODES

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
2	0001	1	0369
2	0003	1	0103
2	0004	1	0108
2	0004	1	0114
2	0006	1	0101
2	0006	1	0102
2	0015	1	0115
2	0017	1	0125
2	0020	1	0130
2	0021	1	0131
2	0022	1	0140
2	0025	1	0145
2	0040	1	0175
2	0040	1	0176
2	0040	1	0177
2	0060	1	0171 *
2	0091	1	0173
2	0092	1	0181
2	0096	1	0258
2	0097	1	0259
2	0100	1	0257
2	0101	1	2711
2	0101	1	5701
2	0108	1	0130
2	0108	1	0132

* Indicates that the procedure is one of the 56 included in the 1975-1980 individual physician time series.

Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
0108	1	0183
0108	1	0184
0120	1	2741
0120	1	5914
0121	1	2742
0125	1	0245
0135	1	0230
0140	1	0232
0141	1	0236
0148	1	0189
0163	1	0229
0164	1	0224
0166	1	0231
0170	1	0143
0171	1	0144
0180	1	0380
0180	1	0381
0181	1	0390
0181	1	0391
0182	1	0382
0182	1	0383
0182	1	0384
0182	1	0385
0182	1	0386
0182	1	0387
0183	1	0393
0184	1	0392
0184	1	0394
0184	1	0395
0184	1	0396
0200	1	5731
0200	1	5951
0216	1	0397
0222	1	0261

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
2	0222	1	0262
2	0223	1	2746
2	0230	1	0263
2	0230	1	0264
2	0280	1	0266
2	0400	1	0340
2	0401	1	0343
2	0402	1	0344
2	0403	1	0346
2	0416	1	0401
2	0416	1	0403
2	0417	1	0411
2	0417	1	0413
2	0450	1	0430
2	0461	1	0441
2	0463	1	0445 *
2	0471	1	0446
2	0473	1	0457 *
2	0476	1	0458
2	0483	1	0470 *
2	0486	1	0462
2	0492	1	0481
2	0520	1	0551
2	0527	1	2848
2	0530	1	0570
2	0612	1	0610
2	0613	1	0613
2	0640	1	0640
2	0706	1	0515
2	0706	1	0517
2	0707	1	0516
2	0864	1	0537
2	0870	1	0616

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
2	0897	1	0682
2	0897	1	0686
2	0940	1	0761
2	0940	1	0762
2	0983	1	0739
2	0984	1	0740*
2	1041	1	0821
2	1041	1	0822
2	1044	1	0811
2	1045	1	0812
2	1045	1	0813*
2	1065	1	0841
2	1066	1	0842
2	1075	1	0851
2	1076	1	0852
2	1076	1	0857
2	1076	1	0858
2	1142	1	0920
2	1143	1	0921
2	1143	1	0922
2	1146	1	0926
2	1146	1	0927
2	1175	1	0966
2	1176	1	0967
2	1176	1	0973
2	1207	1	1008
2	1213	1	1011
2	1213	1	1012
2	1240	1	1046*
2	1241	1	1054
2	1244	1	1131
2	1261	1	1082*
2	1330	1	1159*

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
2	1335	1	1149
2	1401	1	1185
2	1404	1	1163
2	1405	1	1161
2	1406	1	1162
2	1570	1	1401
2	1575	1	1424
2	1576	1	1413 *
2	1681	1	1554
2	1711	1	1548
2	1754	1	1542
2	1754	1	1543
2	1754	1	1544
2	1911	1	1857
2	1911	1	1858
2	1913	1	1853
2	1913	1	1854
2	1915	1	1856
2	1944	1	1864
2	1948	1	1866
2	1948	1	1867
2	1950	1	1862
2	1950	1	1863
2	1952	1	1868
2	1952	1	1869
2	1955	1	1883
2	1956	1	1887
2	1973	1	1897
2	1980	1	1849
2	2017	1	1935
2	2041	1	1955
2	2050	1	1931
2	2057	1	1951

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
2	2060	1	1961
2	2060	1	1962
2	2063	1	1965
2	2070	1	1971
2	2072	1	1975
2	2072	1	1976
2	2080	1	1981
2	2081	1	1982
2	2085	1	1986
2	2130	1	2065
2	2140	1	2071
2	2148	1	2081
2	2148	1	2082
2	2180	1	2111 *
2	2181	1	2113
2	2230	1	2183 *
1	2233	1	2157
2	2265	1	2193 *
2	2361	1	2333
2	2364	1	2334
2	2367	1	2335
2	2375	1	2354
2	2376	1	2351
2	2377	1	2352 *
2	2378	1	2353
2	2391	1	2336
2	2391	1	2337
2	2394	1	2340
2	2394	1	2341
2	2462	1	2410
2	2490	1	2406
2	2525	1	2420
2	2560	1	7505
2	2563	1	2220 *

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
2	2570	1	5034
2	2574	1	2434
2	2580	5	7520
2	2581	1	5032
2	2583	5	7523
2	2584	5	7524
2	2590	1	2324
2	2591	1	2322
2	2600	1	2450
2	2601	1	2443
2	2616	1	2455
2	2620	1	2441
2	2630	1	2630
2	2790	1	2641
2	2955	1	2801
2	2960	1	2815
2	2988	1	2842
2	3107	1	2992 *
2	3108	1	2993 *
2	3110	1	2996
2	3220	1	3121
2	3226	1	3118
2	3226	1	3051
2	3227	1	3119
2	3250	1	3211
2	3267	1	3191
2	3270	1	3179 *
2	3271	1	3180
2	3350	1	3261 *
2	3385	1	3291
2	3400	1	3311 *
2	3402	1	3312
2	3404	1	3313

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
2	3407	1	3316
2	3408	1	3317
2	3410	1	3307
2	3414	1	3318
2	3417	1	3319
2	3418	1	3320
2	3455	1	3283
2	3468	1	3366
2	3475	1	3377
2	3476	1	3375 *
2	3477	1	3396
2	3478	1	3380
2	3479	1	3376
2	3487	1	3392
2	3510	1	3413
2	3560	1	3456
2	3620	1	3515 *
2	3622	1	3517
2	3690	1	3571
2	3720	1	3621
2	3720	1	3623
2	3742	1	3624
2	3746	1	3631 *
2	3747	1	3629
2	3760	1	3661
2	3990	1	3951
2	3991	1	3952
2	3996	1	4009
2	4003	1	4491
2	4003	1	4492
2	4020	1	3931 *
2	4021	1	3932 *

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
2	4023	1	3935
2	4027	1	7366
2	4029	1	3997
2	4029	1	3998
2	4073	1	4321 *
2	4146	1	4031 *
2	4170	1	4122 *
2	4172	1	4123
2	4174	1	4125
2	4351	1	4242 *
2	4486	1	4404
2	4620	1	4611
2	4621	1	4641
2	4622	1	4643
2	4631	1	4642
2	4644	1	4651
2	4644	1	4652
2	4660	1	4711
2	4680	1	4610
2	4681	1	4646 *
2	4685	1	4617 *
2	4686	1	4621 *
4	4696	1	4631
2	4696	1	4632
2	4696	1	4633
2	4713	1	4675
2	4715	1	4676
2	4753	1	4545
2	4780	1	4581
3	4800	3	4885
3	4842	3	4821
3	4850	3	4881

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
3	4851	3	4883
3	4860	3	4802*
3	4860	3	4807
3	4863	3	4800
3	4863	3	4801*
3	4881	3	4855*
3	4897	3	4860*
2	4927	1	4917*
2	5061	1	5020
2	5144	1	5210
2	5155	1	5207*
2	5156	1	5209
2	5173	1	5216
2	5173	1	5217
2	5176	1	5219*
2	5177	1	5220
2	5193	1	5221
2	5282	1	5319
2	5294	1	5298
2	5296	1	5312
2	5297	1	5319
2	5377	1	5305
2	5433	1	5445
2	5435	1	5446
2	5436	1	5447
2	5570	1	5613*
2	5576	1	5611
2	5585	1	5627
2	5592	1	5634
2	5592	1	5625
2	5597	1	5633
2	5621	1	5644
2	5660	1	5660

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
2	5680	1	5702
2	5700	1	5741
2	5782	1	5843
2	5830	1	5931
2	5870	1	5963
2	5871	1	5964
2	5873	1	5962
2	5877	1	5965
2	5927	1	5994
2	5930	1	5995
P	7060	P	7060
5	7060	5	7060 *
P	7101	P	7101
5	7101	5	7101
P	7102	P	7102
5	7102	5	7102 *
P	7311	P	7311
5	7311	5	7311
P	7337	P	7337
5	7337	5	7337 *
P	7582	P	7530
5	7582	5	7530 *
P	7583	P	7531
5	7583	5	7531 *
P	7584	P	7532
5	7584	5	7532 *
8	8000	8	8000
8	8001	8	8001
8	8020	8	8020
8	8361	8	8475 *
8	8700	8	8366 *
8	8891	8	8733
6	9020	C	9311 *

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
6	9070*	-	620111 *
6	9071*	-	610111 *
6	9072*	-	910111
6	9075*	-	63XX11
6	9077*	-	50XX11
6	9078*	-	920111,93XX11
6	9025	C	0211 *
6	9120	C	0368
9	9150	7	0016
9	9151	9	0017
9	9151	9	0025
9	9151	9	0030
9	9153	9	0067
C	9170	E	0230
C	9171	E	0330
6	9370	7	8957 *
6	9372	7	8959
6	9374	7	8960 *
6	9377	7	8961
6	9381	7	8988
6	9384	7	8995 *
6	9394	7	8993
6	9450	7	8999
6	9454	7	8998
6	9533	7	8950 *
6	9534	7	8953
6	9538	7	8954
6	9543	7	9375
6	9545	7	9380
6	9550	7	9381

*Medical care procedures with multiple services.

Blue Shield Type of Service	Blue Shield Procedure Codes	Medicare Type of Service	Medicare Procedure Codes
6	9566	D	9005
6	9736	D	9398
6	9740	D	9401
6	9745	D	9403
6	9750	D	9406

APPENDIX D

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APPENDIX D

PATIENT BORDERCROSSING AND THE DETERMINATION OF MARKET AREAS

INTRODUCTION

The methodologies developed to measure patient bordercrossing and the determination of market areas as well as the measurement of price and utilization of services are particularly critical aspects of this study. We are fortunate to have a massive data base (described in Chapter 3) for this analysis. It has claimed specific information on every service billed to Blue Shield of Michigan for covered services rendered to its members for six years and similar information for most Medicare B eligibles for the same period.

This appendix first discusses the application of central place theory to the determination of market areas. The extent of patient bordercrossing is estimated for Blue Shield residents of each county to identify market areas. Although initially we intended to distinguish between differences which may be associated with alternative groups of services, these differences for five groups of procedures we have experimented with were minimal. Thus to simplify and permit meaningful comparative analysis, we selected a single common market configuration which best compromised the minor differences with the different baskets.

Section two then describes another bordercrossing adjustment which will be used to adjust for the residual bordercrossing which exists between market areas. The effects of these adjustments are described in Chapters 4 through 6.

I. CENTRAL PLACE THEORY

To define market areas, the concept of central place theory from the economics of location was applied.[1] The central place is a source of many goods and services for an area much larger than itself. Certain commodities and services flow to and from this central place to the larger market area. It may be a large or small city but it serves the outlying areas surrounding it. Market forces play a fundamental role in determining the hierarchy of places and their interconnections for the economy as a whole. A review of aggregate medical care utilization statistics clearly indicates that there are central places in the delivery of medical care. For example, medical specialists are found in 35 of the 83 counties in the state and are concentrated in 21 of the 83 counties. These counties serve as primary or secondary central places (see Map D.1.)

Central place theory can be applied to define medical care market areas. Patient origin studies have been performed to measure market areas for hospitals and for hospital service areas. No rigorous analysis of market areas for physician services has yet been performed for Michigan to define physician market areas because of data limitations. The data base being assembled for this research is ideally suited for analysis of patient origin and destination because the data base contains both the county in which the patient resides as well as the county in which the physician practices.

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[1] See Isard (1956) and Lösch (1954)

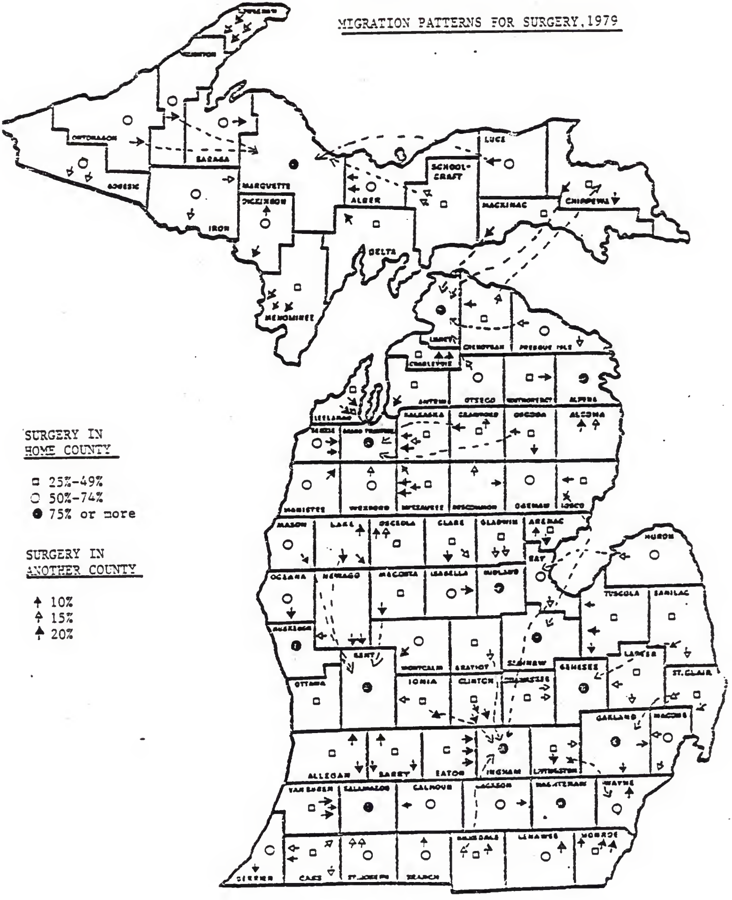
With this data is it possible to measure market areas and their central places by measuring patient flows between counties. Once the market areas are defined, the resource levels (number of doctors, beds, etc.), the utilization (number of physician services, surgeries, patient days, etc.), and the population can be appropriately measured for each market area. By reducing the errors-in-variables problem, it is possible that significant biases in tests of the hypotheses we propose will be greatly diminished.

Bordercrossing: A First View

The existence of central places and market areas was first treated from a review of the flow of patients who are residents of one county and receive medical services within and outside of their home county. Map 1 summarizes the migration pattern of patients for all surgical services billed Blue Cross and Blue Shield of Michigan in 1979. The symbols on the map depict the following percentage ranges of services received within the home county by its residents (25-49% □ ; 50-74%, ○ ; and 75% or more, ●). The arrows show the percentage range of services residents of a county seek in another county and the direction of their migration (10%, ↑ ; 15% ↑ ; 20%, ↑).

On Map D.1, several different patterns of migration are shown. The residents of Monroe county receive 33 percent (□) of their surgical services in Monroe, 41 percent (↑ ↑) of the time they cross the border into Wayne county, and 10 percent (↑) of the services are received in Washtenaw county. Alpena county residents on the eastern side of the lower peninsula receive 77 percent (●) of their surgical care in their own county and go to Emmet county on the other side of the state for 8 percent (↑) of their services, with the remainder of care spread around the state.

Map D.1


MIGRATION PATTERNS FOR SURGERY, 1979
SURGERY IN HOME COUNTY
25%-49%
50%-74%
75% or more
SURGERY IN ANOTHER COUNTY
10%
15%
20%
MARQUETTE
IRON
ALGER
SCHOOLCRAFT
LUCE
MACKINAC
CHIPPEWA
DELTA
MENOMINEE
HURON
TUSCOLA
SANILAC
BAY
OTTAWA
KENT
IONIA
CLINTON
GENESEE
ST. CLAIR
OAKLAND
MACOMB
ALLEGAN
BARRY
EATON
INGHAM
WAYNE
CALHOUN
LENAWEE
MONROE
CASS

The residents of the following thirteen counties receive over 75 percent of their surgical services in their county of residence; Alpena (77%); Emmet (85%); Genesee (92%); Grand Traverse (86%); Ingham (91%); Kalamazoo (89%); Kent (94%); Midland (78%); Marquette (88%), Muskegon (87%); Oakland (75%); Saginaw (87%); and Washtenaw (84%).

The map also indicates that physicians in each of these thirteen counties are also receiving significant flow of patients from other counties. Based upon an initial review, the physicians in counties receiving both a lot of "in" migration from residents of other counties and who are providing at least 75% of the services to the residents of the physician's county are probably practicing in central places in each market area. However, some of these counties may be found to be a secondary central place in a market area once a more thorough location analysis is completed. For example, Alpena county may be found to be a secondary central place in a market area that includes the other counties which have significant patient flows to Emmet county.

A more precise measurement of bordercrossing should consider the absolute number of services, the dollar charges, whether the surgical services were basic or complex. For example, Alpena residents seek 76.9% of all services with Alpena and go to Emmet for 8.2% of services; however, the services provided in Emmet represent 16.2% of total payments. Therefore, Emmet county physicians deliver higher cost surgical services to Alpena county residents and Alpena is in the Emmet market. Also, once the other variables are considered in the analysis, counties such as Wayne may be defined as a market area and central place based upon the absolute magnitude of that market area, its population, and the type of services performed in Wayne county. The more precise measures have also been performed but a review of the initial analysis is relevant to the evolution of the methodology.

Determination of County Market Areas: A First View

To identify central places, the flow of patients between their resident county to each of 83 counties in the State of Michigan is used. Table D.1 shows these calculations for the Blue Shield of Michigan members who are residents of Alpena county during 1979. For each county a similar calculation is used to define the county market area for its residents. A review of those calculations for each county show that in general there is always some limited flow of patients from one county to many other counties at a level of one to two percent, but there are only a few flows out of any county at a five percent or greater level. A standard set of eighty five percent of the services received by the Blue Shield of Michigan residents of a county captures all of the five percent or greater individual patient migration flows and summarizes the major market area for the county's residents.

Once the market areas are defined for each county at the 85 percent level then potential central places in the county's market area are identified. To identify possible central places the following criteria are followed. If an individual county provided at least seventy five percent of the patient services received by its Blue Shield of Michigan residents then that county is classified as a possible central place. Any county delivering 75% of care to its own Blue Shield of Michigan residents is also considered to be a possible central place for any other county if it is identified in another county's 85 percent market area. In addition, in each county market area any individual county receiving ten percent or the largest percent outflow of the county's Blue Shield of Michigan patient services is considered to be a possible central place in that county's market area.

TABLE D.1

SURGICAL SERVICES RECEIVED BY RESIDENTS OF ALPENA COUNTY IN VARIOUS COUNTIES IN MICHIGAN, 1979

RESIDENT COUNTY: ALPENA

COUNTY	TOTAL PROFESSIONAL SERVICES	% OF TOTAL	TOTAL PROFESSIONAL CHARGES	% OF TOTAL	TOTAL PROFESSIONAL PAYMENTS	% OF TOTAL
4 ALPENA	2635	76.91	248559	61.64	220716	62.70
24 EMMETT	281	8.20	65471	16.24	56884	16.16
73 SAGINAW	72	2.10	25926	6.43	20832	5.92
63 OAKLAND	47	1.37	8801	2.18	5892	1.67
82 WAYNE	46	1.34	9546	2.37	7983	2.27
81 WASHTENAW	41	1.20	12050	2.99	10138	2.88
9 BAY	40	1.17	1490	0.37	1429	0.41
70 OTTAWA	38	1.11	1283	0.32	1090	0.31
50 MACOMB	35	1.02	3077	0.76	2171	0.62
99 OUT OF STATE/UNKNOWN	35	1.02	12599	3.12	12222	3.47
28 GRAND TRAVERSE	33	0.96	3704	0.92	3009	0.85
33 INGHAM	19	0.55	1268	0.31	1071	0.30
65 OGEMAW	15	0.44	485	0.12	384	0.11
41 KENT	12	0.35	1608	0.40	1364	0.39
25 GENESEE	11	0.32	1360	0.34	1048	0.30
60 MONTMORENCY	11	0.32	480	0.12	416	0.12
74 ST CLAIR	10	0.29	1592	0.39	1293	0.37
1 ALCONA	8	0.23	253	0.06	189	0.05
69 OTSEGO	6	0.18	298	0.07	145	0.04
13 CALHOUN	4	0.12	400	0.10	230	0.07
52 MARQUETTE	4	0.12	164	0.04	132	0.04
20 CRAWFORD	3	0.09	57	0.01	41	0.01
56 MIDLAND	3	0.09	185	0.05	150	0.04
3 ALLEGAN	2	0.06	225	0.06	219	0.06
18 CLARE	2	0.06	255	0.06	215	0.06
35 IOSCO	2	0.06	250	0.06	234	0.07
45 LEELANAU	2	0.06	150	0.04	150	0.04
54 MECOSTA	2	0.06	910	0.23	625	0.18
17 CHIPPEWA	1	0.03	25	0.01	15	0.00
22 DICKINSON	1	0.03	28	0.01	28	0.01
29 GRATIOT	1	0.03	25	0.01	15	0.00
37 ISABELLA	1	0.03	19	0.00	15	0.00
39 KALAMAZOO	1	0.03	160	0.04	475	0.13
47 LIVINGSTON	1	0.03	40	0.01	35	0.01
61 MUSKEGON	1	0.03	525	0.13	1150	0.33
NON-RESIDENT COUNTIES	791	23.09	154709	38.36	131289	37.30
TOTAL	3426	-	403268	-	352005	-

Grouping County Market Areas

Once the individual county market areas have been identified the next step is to group the individual county market areas with related counties and define the market areas. Table D.2 summarizes the 85 percent county market areas for several counties in the upper lower peninsula.

Two criteria used to define potential central places are shown in this table. The dots (•) indicate counties where physicians practicing in that county provide 75 percent or more care to Blue Shield of Michigan residents of that county. The x's indicate that the physicians practicing in that county provide 10 percent or more of the care to Blue Shield of Michigan residents of the other county.

All of the counties on the table show Emmet county as a possible central place. It is clear that physicians in Emmet county provide significant medical care to the Blue Shield of Michigan residents of the upper lower peninsula. For most of these counties Emmet county was marked as a possible central place based upon both criteria. In all cases Emmet is a potential central place since its physicians provided more than 75 percent of its own surgical care. In many cases Emmet county physicians provided 10 percent or more of the surgical care to the specific county on the list or was the largest second place of surgical care for the residents of the other counties. This is true for Charlevoix, Cheboygan, Chippewa, Emmet, Mackinac, Otsego, and Presque Isle.

However, some of those counties 85 percent market areas have some other possible central places and criteria are needed to determine whether or not the county should be placed in the Emmet county market area in

TABLE D.2 COUNTY MARKET AREAS

<u>Upper Lower Peninsula Percent of Services of a County's Residents 1979</u>

Resident County \ Providers County	Alcona	Alpena •	Charlevoix	Cheboygan	Chippewa	Crawford	Emmet •	Genesse •	Grand Traverse •	Iosco	Luce	Mackinac	Marquette •	Midland •	Montcalm	Montmorency	Oakland •	Otsego	Presque Isle	Saginaw •	St. Clair	Schoolcraft	Washtenaw •	Wayne	Total
Alcona	8.5%	•x 36.9%					• 5.5%	3.8%		7.7%				4.4%			8.4%			3.5%			4.5%	5.6%	88.7%
Alpena		• 76.9					• 8.2																		85.1
Charlevoix			39.4%				•x 47.3																		86.7
Cheboygan				37.9%	x 19.2%		•x 26.6											1.8%							85.5
Chippewa					31.5		•x 27.5					x 19.0%											• 2.9		83.2
Crawford						41.7%	• 8.0		•x 15.5%						2.4%		• 3.1	x 12.1						2.6	85.4
Emmet				2.8			• 84.6																		87.4
Mackinac					7.0		•x 23.8				8.6%	28.1	• 2.4%				• 2.4					5.6%	• 2.4	6.2	86.5
Montmorency		•x 12.7					• 6.3									45.8%	• 4.1	7.0	4.3%					6.9	87.1
Otsego							•x 15.4		• 4.9								• 4.0	57.5			5.0%				86.8
Presque Isle		•x 15.9					•x 17.5												53.5						86.9

(No other counties over 2%)

Potential Central Place

• Counties where 75 percent or more of services provided to its residents by physicians within residents county

x Ten percent or more of these county's services are provided in this county.

whole or in part. Chippewa County, for example, has a potential central place of Mackinac county where 19 percent of surgical care to Chippewa residents is received. Mackinac county is clearly tied to Emmet. Three other potential places (maybe four) provide surgical care to Mackinac residents--Marquette, Oakland, Washtenaw and possibly Wayne counties. But they provide about half the surgical care that Emmet county physicians provide even when all four counties are combined. Therefore, Emmet county is a central place for Mackinac county and thus it is also the central place of Chippewa. Similarly Otsego is assigned to Emmet county.

Determining whether or not Crawford county should be placed in the Emmet county central place is more complicated. Grand Traverse, Otsego, and Emmet are the three prime choices. Grand Traverse provides the most care but Otsego is clearly in the Emmet market area and the two counties together provide a greater share of surgical care to Crawford residents than Grand Traverse. To decide in which market to place Crawford it is necessary to refer to payment data in addition to services. The payment data shows that Emmet county physicians receive 18.49 percent, Otsego physicians receive 8.57 percent while Grand Traverse physicians receive 17.21 percent. The absolute percent of services provided by Emmet physicians is lower than Grand Traverse, but the payments are higher. Thus, Crawford county is assigned to the Emmet market area.

Four counties in Table D.2 remain to be assigned. These are Alcona, Alpena, Montmorency and Presque Isle. Two of these counties, Alcona and Montmorency clearly have Alpena as their primary central place based upon percentage of surgery and on percent of payments (not shown in tables).

Presque Isle could be assigned to Emmet. Alpena provides the majority of services to its own residents but when payments are considered only 62.7 percent go to Alpena physicians and 16.16 percent go to Emmet physicians. Alpena appears to serve a central place for the three counties and is itself tied to Emmet as is each of the other three counties. Therefore, they should all be assigned to Emmet, but it may be useful to consider the aggregation of these four counties as a sub-market within the Emmet county market.

Statistics on Wayne and Oakland counties are shown in Table D.3 As can be seen, the two counties are clearly closely associated; however, it is desirable to treat both as central places. First, these two counties provide a large share of all surgery services provided in the state. There is a large amount of bordercrossing since the county lines do not correspond to the precise market areas. If the county lines were modified somewhat, there would be two central places that provide 75 percent, or even 85 percent of the services to residents living within each market. Based upon the absolute number of services provided, the number and share of services each county provides to other counties in the state and the extensive representation of all medical specialties within each county, we propose to treat them both as central places.

The examples above describe the preliminary method and criteria for assigning counties to market areas. With these criteria it is usually possible to allocate a county to one market area. In a few cases it is obvious that some counties lie between two market areas and depending on where the population live within the county, they are migrating to one market area and its central place or to the other market area and its central

TABLE D.3

SELECTED STATISTICS ON
WAYNE, OAKLAND COUNTIES

Resident County: Oakland

	Total Services	Percent of Total	Total Payments	Percent of Total
Oakland	364,072	74.78%	27,165,817	71.45%
Wayne	59,678	12.26	5,352,903	14.08
Total State	486,846		38,019,337	

Resident County: Wayne

	Total Services	Percent of Total	Total Payments	Percent of Total
Wayne	624,313	71.9%	49,682,554	68.21%
Oakland	167,418	19.28	14,850,405	20.39
Total State	868,158		72,839,381	

place. Also, sometimes it is clear that one area provides a lot of low cost services while the other provides the higher cost, more complex services based upon percent of payment to each central place.

The Final Market Areas

After the initial calculations were made it was clear that the concept of central place theory could be applied to determine market areas but that some refinements in the methodology were appropriate to deal with certain problems and limitations. First there are over 2,900 surgery procedures (4,300 procedures when all types of service are considered), defined for billing to Blue Shield or Medicare B. These procedures vary in complexity from very simple procedures such as an incision of a cyst to a very complex brain surgery. The charges vary from a few dollars to several thousand dollars. Therefore, it is necessary to develop a border-crossing methodology, which weights the procedures by their relative value. A procedure was developed to calculate the migration pattern using relative charges as weights. The weighting method is essentially the same as the one described in the section on price and quantity. Another issue was the high cost of performing these calculations. To reduce the cost we developed several groupings of 424 procedures which we refer to as market baskets.

A surgical market basket which contains 342 procedures, was used to calculate a weighted migration analysis for surgery. In addition a weighted migration analysis was performed with;

(i) a medical care market basket with 40 procedures;

(ii) an obstetric basket with 13 procedures;

(iii) a basket of 116 procedures which will be the one most carefully examined in subsequent work; and

(iv) a group of 424 procedures which was the largest one that could be analyzed. (A discussion of these market baskets is found in Chapter 4.)

An example of the weighted migration study for surgery is shown in Table D.4 for Alpena county Blue Shield of Michigan residents. This table can be compared with Table D.1 of this chapter. The total professional services in Table D.5 are weighted by relative charges rather than by simply the number of services given in Table D.1. Physicians in Emmet county provide 16.3% of the weighted surgical services compared to 8.2% of the actual services (Table D.1). Although Alpena physicians provide the majority of services to the Blue Shield residents it is clear that the residents go to Emmet county for relatively more serious medical requirements. The surgical market basket includes only 340 procedures but represents $324,391 of charges (Table D.4) compared to $403,268 for all surgical services included in Table D.1. These weighted migration calculations support the initital decision to include Alpena in the market area with Emmet county as a central place.

Table D.5 summarizes the weighted migration of all Blue Shield members who reside in areas that we include in the market area with Emmet. In all cases the weighted percent of professional services received in Emmet exceeds the absolute percent of actual services shown in Table D.2.

Similar analyses have been performed on the other market baskets. Our analysis has found that differences in the designation of markets among these groups of procedures were minimal. Given the convenience of having single market classification for the entire study, we will use the configuration

TABLE D.4

SURGICAL SERVICES RECEIVED BY RESIDENTS
OF ALPENA COUNTY IN VARIOUS COUNTIES IN MICHIGAN,
1979 (WEIGHTED BY RELATIVE CHARGES)

RESIDENT COUNTY: ALPENA

COUNTY	TOTAL PROFESSIONAL SERVICES	% OF TOTAL	TOTAL PROFESSIONAL CHARGES	% OF TOTAL	TOTAL PROFESSIONAL PAYMENTS	% OF TOTAL
4 ALPENA	3190.58	67.24	215477	58.58	190034	0.0
24 EMMETT	773.69	16.30	49407	13.43	43563	0.0
84 UNKNOWN/OUT OF STATE	197.63	4.16	11036	3.29	10664	0.0
73 SAGINAW	162.47	3.42	12366	3.34	10820	0.0
82 WAYNE	86.74	1.83	8067	2.02	6544	0.0
63 OAKLAND	58.93	1.24	4933	1.17	3801	0.0
81 WASHTENAW	54.04	1.14	5478	1.36	4423	0.0
28 GRAND TRAVERSE	48.24	1.02	3626	0.90	2932	0.0
9 BAY	31.86	0.67	2315	0.67	2179	0.0
50 MACOMB	28.93	0.61	2952	0.64	2061	0.0
71 PRESQE ISLE	17.27	0.36	1206	0.32	1023	0.0
33 INGHAM	15.67	0.33	1193	0.31	996	0.0
41 KENT	14.72	0.31	1008	0.28	901	0.0
25 GENESEE	11.36	0.24	1115	0.26	844	0.0
74 ST CLAIR	8.57	0.18	617	0.11	368	0.0
68 OSCODA	5.17	0.11	390	0.10	324	0.0
60 MONTMORENCY	4.73	0.10	360	0.09	300	0.0
35 IOSCO	4.70	0.10	250	0.07	234	0.0
3 ALLEGAN	4.16	0.09	225	0.07	219	0.0
13 CALHOUN	3.37	0.07	400	0.07	230	0.0
1 ALCONA	3.02	0.06	258	0.06	202	0.0
18 CLARE	2.82	0.06	255	0.07	215	0.0
56 MIDLAND	2.56	0.05	185	0.05	150	0.0
69 OTSEGO	2.18	0.05	298	0.04	145	0.0
39 KALAMAZOO	2.03	0.04	160	0.05	160	0.0
52 MARQUETTE	2.02	0.04	130	0.04	115	0.0
70 OTTAWA	1.32	0.03	96	0.02	74	0.0
58 MONROE	1.23	0.03	150	0.03	100	0.0
54 MECOSTA	1.11	0.02	110	0.03	100	0.0
65 OGEMAW	1.06	0.02	95	0.02	60	0.0
20 CRAWFORD	0.74	0.02	57	0.01	41	0.0
6 ARENAC	0.70	0.01	39	0.01	39	0.0
22 DICKINSON	0.43	0.01	28	0.01	28	0.0
47 LIVINGSTON	0.38	0.01	40	0.01	35	0.0
17 CHIPPEWA	0.25	0.01	25	0.00	15	0.0
29 GRATIOT	0.25	0.01	25	0.00	15	0.0
37 ISABELLA	0.25	0.01	19	0.00	15	0.0
NON-RESIDENT COUNTIES	1554.55	32.76	108914	33.57	93935	33.08
TOTAL	4745.13	-	324391	-	283969	-

TABLE D.5

COUNTY MARKET AREAS

UPPER LOWER PENINSULA PERCENT OF SERVICES OF A COUNTY'S RESIDENTS 1979

WEIGHTED MIGRATION SURGERY

Resident County / Providers County	Alcona	Alpena	Charlevoix	Cheboygan	Chippewa	Crawford	Emmet	Genesee	Grand Traverse	Iosco	Kent	Luce	Mackinac	Marquette	Macomb	Midland	Montcalm	Montmorency	Oakland	Otsego	Presque Isle	Saginaw	St. Clair	Schoolcraft	Washtenaw	Wayne	Total
Alcona	3.6	37.2					13.0	3.6		6.1				4.4	2.7				8.0			5.2			4.4	2.1	90.3
Alpena		67.2					16.3															3.4					86.9
Charlevoix			30.5				56.5		5.4																		92.4
Cheboygan				28.5	15.5		37.9		1.9																1.7		85.5
Chippewa					34.6		39.1					1.5	5.0						1.8						1.6	2.2	85.8
Crawford						30.0	25.8		15.5						2.2				2.9	6.4		6.2			1.6	3.0	93.6
Emmet							90.4																				90.4
Mackinac					16.4		26.8				5.9	3.6	22.1	4.0					4.5					4.8		2.7	90.8
Montmorency		17.1				6.4	8.8											35.3	8.8	5.9	2.6					4.0	88.9
Otsego							23.1		5.7									2.8	7.6	49.1							88.3
Presque Isle		22.7					32.3														33.1						88.1

shown in Map D.2 which is a compromise of the minor differences associated with the alternative market baskets. The 83 counties are also listed alphabetically with their area codes in Table D.6.

Table D.7 reports the percentage of surgery services weighted by relative charges received by residents of a market area within that same market area. For eight of the market areas, eighty percent or more of the weighted services are received within the resident market area. In six of the market areas from seventy to seventy-nine percent of the services are received within the resident market area.

Market area eight has the lowest percent of services rendered to its own residents. It provides a large number of services within its own borders. However, its close proximity to the Oakland and Wayne market areas results in migration to both those areas at the level of 17.5 and 17.8 percent respectively. We have chosen to treat it as a separate market area because of the number of services rendered within the market area, since it is not feasible to divide a county. Similarly in market areas 11 and 14 which are the two largest market areas in the state, there is a significant percentage of bordercrossing between these two markets. Similarly, in market area four there is some flow of bordercrossing from Manistee, Wexford, Missaukee and Roscommon counties to Kent county but the stronger flow is to Grand Traverse.

If we divide counties in forming the market areas, we could increase the percentage of services within each market area received by residents of that market area. This is not feasible because all our primary and secondary data are specified by county and we cannot disaggregate the data. We will handle the residual bordercrossing by adjusting the population by a migration factor. This adjustment is discussed in the section on effective population.

MAP D.2
PHYSICIAN MARKET AREAS
IN MICHIGAN

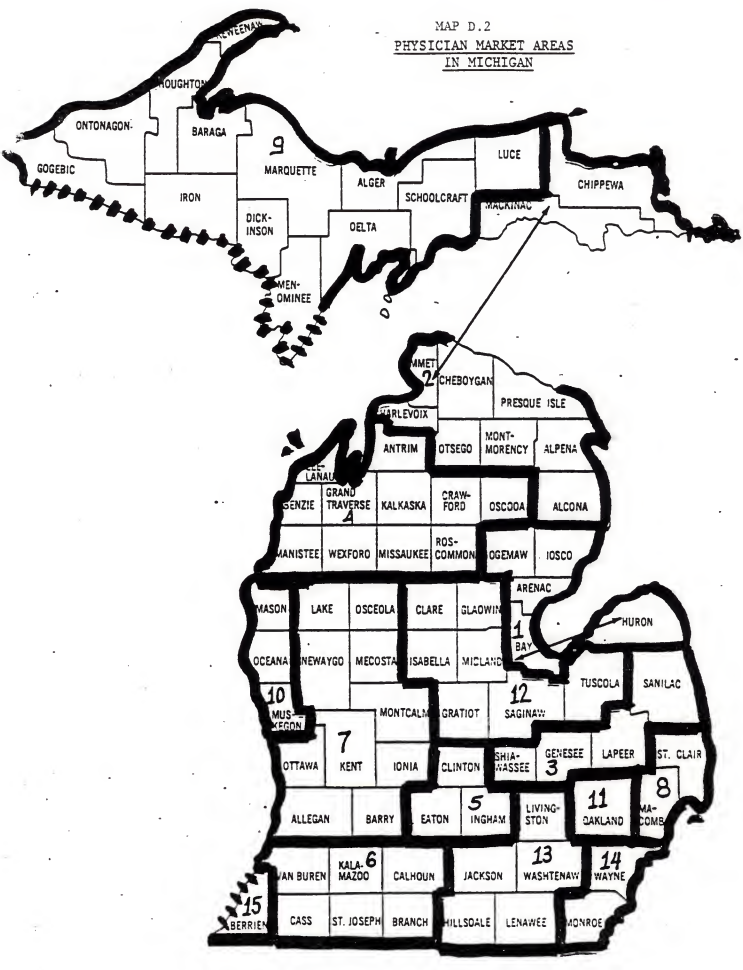


TABLE D.6

COUNTY DESIGNATIONS AND CODES

County Code	County	Market Area	County Code	County	Market Area
01	Alcona	2	43	Lake	7
02	Alger	9	44	Lapeer	3
03	Allegan	7	45	Leelanau	4
04	Alpena	2	46	Lenawee	13
05	Antrim	4	47	Livingston	13
06	Arenac	1	48	Luce	9
07	Baraga	9	49	Mackinac	2
08	Barry	7	50	Macomb	3
09	Bay	1	51	Manistee	4
10	Benzie	4	52	Marquette	9
11	Berrien	15	53	Mason	10
12	Branch	6	54	Mecosta	7
			55	Menominee	9
13	Calhoun	6	56	Midland	12
14	Cass	2	57	Missaukee	4
15	Charlevoix	2	58	Monroe	14
16	Cheboygan	2	59	Montcalm	7
17	Chippewa	2	60	Contmorency	2
18	Clare	12	61	Muskegon	10
19	Clinton	5			
20	Crawford	4	62	Newaygo	7
21	Delta	9	63	Oakland	11
22	Dickinson	9	64	Oceana	10
			65	Ogemaw	1
23	Eaton	5	66	Ontonagon	9
24	Emmett	2	67	Osceola	7
			68	Oscoda	4
25	Genesee	3	69	Otsego	2
26	Gladwin	12	70	Ottawa	7
27	Gogebic	9			
28	Grand Traverse	4	71	Presque Isle	2
29	Gratiot	12			
			72	Roscommon	4
30	Hillsdale	13			
31	Houghton	9	73	Sagniaw	12
32	Huron	1	74	St. Clair	8
			75	St. Joseph	6
33	Ingham	5	76	Sanilac	3
34	Ionia	7	77	Schoolcraft	9
35	Iosco	1	78	Shiawassee	3
36	Iron	9			
37	Isabella	12	79	Tuscola	12
38	Jackson	13	80	Van Buren	6
39	Kalamazoo	6	81	Washtenaw	13
40	Kalkaska	4	82	Wayne	14
41	Kent	7	83	Wexford	4
42	Keweenaw	9	84	Out-of-State	16

TABLE D.7

Percentage of Weighted Surgical

Services Received by Residents of

a Market Area Within Their Resident Market Area

Market Area	Percentage	Excluding Out-of-State
1	70%	72%
2	83	86
3	85	86
4	72	74
5	89	90
6	88	91
7	87	88
8	62	63
9	77	94
10	81	82
11	75	77
12	82	84
13	83	85
14	70	71
15	78	88

II. UTILIZATION RATES: ACTUAL AND EFFECTIVE POPULATION

The utilization index for the aggregated data will be expressed as utilization per eligible beneficiary. (The micro data to be obtained from a sample of physicians will provide an index of the intensity with which services are provided per patient). While one approach may be to simply divide total utilization by the eligible population (and this index will be examined), it does not account for bordercrossing at the county level or even the residual bordercrossing once the counties have been grouped into market areas by the methods previously described.

The population of a market area should reflect the potential demanders of resources who live within the boundary of the market area, but it should also reflect demanders who reside outside of the physical boundary if they behave as if they lived within the boundary. In most studies it is not possible to calculate this effective population of an area. The data which we use to define patient migration and market areas can also be used to calculate the effective population served by a market area.

In developing an adjustment factor for the county (market area) population to reflect net migration of residents and non-residents the following two factors should be considered. First, since only a fraction of the population will actually receive care in any one year, it is assumed that the population that does not receive care would behave in the same manner as those that receive care when they do require care. County or market area total population will, therefore, be adjusted by the percentage rate of migration of patients who actually receive care.

Second, there is a wide range of services, and since the pattern of migration may differ for different types of service, it may be appropriate to develop the factor so that it considers both the number of services and the relative complexity of the service. Without this latter consideration each service would have an equal weight in allocating population. By allocating population with standardized quantities of service a more accurate measure of the population served will be obtained. This is particularly important to accurately measure the population served by central places within market areas. It may appear that such central places have excess medical resources if this adjustment were not made. Too often in measuring utilization rates, investigators have failed to account for individuals who exercise their demand in several markets. They may obtain the basic necessities near home, but travel to central places for major purchases. The method that is proposed effectively allocates population into various markets in proportion to the quantity demanded in each market.

Two ways of estimating effective population are described. The first method assigns an equal weight to each procedure; while the second introduces standardized quantities for the adjustment. Because the latter is conceptually a simple extension of the former, it is discussed first below in greater detail even though it will not be used.

Effective Population by Number of Services

Effective population of a county or market area differ from actual population of a county or market area. Some people live in a county but never seek any medical care there. Maybe they go to a family doctor who practices in another county. Some people get some medical care in one

county and some care in other counties. One way to allocate patients to a county is by their residence, but that overlooks the out migration or border-crossing.

Residents of each county (market area) can seek medical care in any one of the other counties (market areas) in the state. Thus there is a potential flow of patients that may fill every cell of an 83 x 83 matrix, in the State of Michigan, with the county as the unit of observation. Therefore, to describe the calculation of effective population matrix notation will be used.

Given the actual population of each county (market area) it can be represented by a column matrix A.

$$A_h = \begin{bmatrix} a_1 \\ a_2 \\ \cdot \\ \cdot \\ \cdot \\ a_h \end{bmatrix}$$

Where a_h equals the actual population (resident population) of county h (or market area h).

To calculate the effective population, begin with matrix K.

$$K = \begin{bmatrix} k_{11} & \cdots & k_{1t} \\ \vdots & & \vdots \\ k_{s1} & & k_{st} \end{bmatrix}$$

i=1,...,m (County of Service)

j=1,...,m (County of Residence)

Each k_{ij} equals the number of services that residents of county j receive in county i.

The sum of the elements along the ith row represents the total number of services provided in the ith county; while a summation of the elements in the jth column indicates the total number of services consumed by residents of the jth county.

Dividing each element by the corresponding column summation produces a new matrix (call this K^1) where each element, say k^1_{ij}.., represents the percent of all services provided in the jth county to recipients residing in the ith county. The effective population in this method would be defined by $E = K^1 \cdot A$. Thus, a county's total effective population is the proportion of all services county 1 residents receive in that county multiplied by county 1's population; plus the proportion of all services county 2 residents receive in that county multiplied by county 2's population and so on through all 83 counties. Or more simply if residents of one county consume, say 10 percent of their services in another county, the latter's effective population is increased by 10 percent of the former's population.

Effective Population by RVUs

In the first method, each service is assigned an equal weight. This method applies the weights Z_i defined in equation (1) to derive the K^1 matrix

such that the element k^1_{jk} represents the percent of the total RVUs (instead of total services) provided in the jth county which are received by residents of the ith county. The effective population is given again by $E = K^1A$. By weighting services, this method is clearly superior to the first and it is the one which will be used exclusively for the study.

APPENDIX E

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APPENDIX E

List of Secondary Data Elements

	Variables	Sources	Years Available
I.	Population Data - BCBSM Subscribers		
	Number of BCBSM Subscribers - Male " " " - Female " " " - Total	BCBSM, Group Utilization System, Monthly Membership Report	1977-1980
II.	Age Distribution - Michigan		
	Age Distribution: 0-4 5-14 15-24 25-34 35-44 45-54 55-64 65 + Total by sex	1979 Census	1970, 1980
III.	Age Distribution: BCBSM Membership, Regular Business		
	Age Distribution: 0-4 5-14 15-24 25-34 35-44 45-54 55-64 65 + Total by sex	BCBSM, Monthly Membership Report	1978-1980
IV.	Age Distribution - BCBSM membership, Complementary and Total Contracts		
	Complementary Business: Age Distribution: 0-64 " " 65 +	BCBSM, Monthly Membership Report	1978-1980
	Total of Regular and Complementary Business	(Same as Above)	1978-1980
V.	Population Data		
	Population, 1980 provisional	Michigan Department of Management & Budget Preliminary & Provisional Census	1980

List of Secondary Data Elements

(All data is available by county)

Variables	Sources	Years Available
V. Continued		
Population projections: 1980 and 1985	Michigan Department of Management & Budget	1980-1985
Elderly population	Michigan Statistical Abstract	1970, 1976, 1977
Percentage of White " " Black " " Other Minority	Area Resource File (ARF), 1970 Census	1970, 1980
BCBSM, Total Membership BCBSM, Auto Membership	BCBSM, Exposure (By County) Report	1976-1980
BCBSM, Total Penetration BCBSM, Auto Penetration	Calculated	1975-1980
VI. Health Resources - 1		
Number of M.D.'s " " D.O.'s " " D.P.M.'s	BCBSM, Registrar's Office (Provider Reports)	1975-1980
M.D./ population ratio D.O./ " " D.P.M./ " "	Calculated	1975-1980
Number of Medical Schools	ARF, 1979 Report	1970-1980
Number of Emergency Rooms	AHA Guide, 1979	1975-1980
Number of Outpatient Surgery Clinics	Michigan Department of Health, Licensing & Certification Department	1976-1980
Number of pharmacies	BCBSM, Registrar's Office (Provider Reports)	1976-1980

List of Secondary Data Elements

(All data is available by county)

	Variables	Sources	Years Available
VII.	Health Care Resources - 2		
	For Michigan and BCBSM: Number of General Practitioners (G.P.'s); " " General Surgeons; " " Family Practice Physicians; " " Internal Medicine Physicians	BCBSM, Registrar's Office (Provider Reports)	1976-1980
VIII.	Health Care Resources - 3		
	For Michigan and BCBSM: Number of O.B.'s	BCBSM, Registrar's Office (Provider Reports)	1976-1980
IX.	Number of Hospitals and Hospital Beds		
	Number of Hospitals; " " Long-term unit (LTU) Beds	MDPH, Comprehensive Report of Hospitals	1975-1980
	" " Psych Beds	Michigan Department of Mental Health	1975-1980
	" " Hospital Beds plus LTU & Psych Beds; " " Hospital Beds minus LTU & Psych Beds	Calculated	1975-1980
	Number of Nursing Care Beds	MDPH, Comprehensive Report of Nursing Facilities	1977-1980
X.	Housing Information		
	Number of Housing Units: 1975	Michigan Statistical	1975
	" " " " 1976-1979	Calculated from Michigan HUD, Residential Permit Report: Individual places, privately owned	1976-1980
	Number of persons per household	Calculated	1975-1980

List of Secondary Data Elements

(All data is available by county)

Variables	Sources	Years Available
X. Continued		
Percent of population in:		
1) Group Quarters 2) Rural Areas	1970 Census	1970
Square Miles per County	ARF, 1979 Report	1970-1980
Persons per Square Mile	Calculated	1975-1980
XI. Income and Medicaid Information - Michigan		
Average Weekly Earnings	M.E.S.C., Special Computation	1975-1979
Per Capita Income	Sales Mgmt. Magazine	1975-1980
Michigan Medicaid: Payments to Physicians Monthly Average Number of Recipients Total Payments (to all vendors)	M.D.S.S., Medical Assistance- (Medicaid). DSS Publication 122.	1975-1979
XII. BS Procedures: Charges, Payments, and Services		
BCBSM Charges " Payments " Number of Services	BCBSM, MVF Paid-In-Full Performance Report: (Short) by County.	1975-1980
XIII. Health Care Resources -4		
Number of Chiropractors " " Thoracic Surgeons: M.D., D.O., Total	BCBSM, Registrar's Office (Provider Reports)	1975-1980
Number of R.N.'s (active)	M.D.P.H., Survey of Licensed R.N.'s	1975, 1977, & 1979

List of Secondary Data Elements

(All data is available by county)

	Variables	Sources	Years Available
XIV.	Education Information		
	Number of School Pupils	Mi. Dept. of Education (M.D.E.), County Tally of School Membership	1975-76 to 1979-80
	Number of Ethnic pupils	M.D.E., Office of School & Community Affairs	1975-1979
	School Membership: % of Population	Calculated	1975-1979
	Median School Years Completed: a) Female b) Male	1970 Census	1970, 1980
	Average Per Diem Cost (Bed Density)	Calculated	1975-1980
XV.	Skilled Nursing Facility Information		
	Number of skilled beds	MDPH	1980
	Number of basic beds	MDPH	1980
	Number of hospital LTU beds	MDPH	1980
	Number of HLTU facilities	MDPH	1980
XVI.	Mortality/Morbidity Indices		
	Deaths per 100,000 age-sex-race adjusted	MDPH	1975-1979
	Communicable diseases per 100,000	MDPH	1975-1979

APPENDIX F

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Blue Cross/Blue Shield of Michigan
Physician Questionnaire

PLEASE PRINT OR TYPE

BCBSM Provider Number:_______________

Physician Name:_______________

Primary Location: Address:_______________

City:_______________ State:_______________ Zip:_______________

****

1. Do you accept all new patients? /_/ yes /_/ no

2. On an average Saturday and Sunday, how many hours do you spend with patients in your office? _______ hours. (Please round to nearest whole number.)

3. How many patients do you consult with by telephone on an average day? _______ patients.

4. Are you in a solo or group practice?

   /_/ solo.

   /_/ group. Including yourself, how many physicians are in the group? _______ physicians.

5. Did you receive your medical degree in the U.S., Canada, or Great Britain?

   /_/ yes /_/ no

6. In what year did you graduate from medical school? _______

7. Are you board certified in your specialty? /_/ yes. Which specialty _______________? /_/ no.

8. In what specialty do you deliver most of your services? _______________

9. Do you belong to a medical school faculty?

   /_/ yes. How many hours per week do you normally spend performing faculty-related duties? _______ hours.

   /_/ no.

10. In the last complete working week, how many . . .

    a) Patients did you see in your office? _______ patients.
    b) How many hours did this involve? _______ hours.
    c) Visits did you make to hospital inpatients? _______ visits.
    d) Visits did you make to nursing homes? _______ visits.
    e) House calls did you make? _______ calls.
    f) Visits to patients in a hospital emergency room did you make? _______ visits.
    g) Visits did you make to outpatient clinics? _______ visits.

11. How many total hours did you spend seeing these patients? _______ hours.

12. How long (in days) would I have to wait for a non-emergency appointment if I called you first thing this morning, if I . . . (If "Today", Code 0)

a) was a regular patient of yours? _______ days.
b) was not an established patient of yours? _______ days.

13. How long (in minutes) after the scheduled appointment time do your patients ordinarily have to wait before seeing you? _______ minutes.

14. How long does it typically take your patients to travel to your office?

/_/ Less than 1/2 hour. /_/ 1/2 hour or more.

15. In your practice, how many persons do you have employed in the following categories, and what are their average weekly wages?

	#			$ Wages
a)	_______	Secretary/Clerical	d)	_______
b)	_______	Registered Nurse	e)	_______
c)	_______	Technicians	f)	_______

16. How many examining rooms do you use in your office? _______ rooms.

17. Approximately what percentage of your patients . . . (Please round to the nearest whole number.)

a) Have no private or government insurance at all for physicians' services? _______ %
b) Have Blue Shield? _______ %
c) Have Medicaid? _______ %
d) Have Part B Medicare? _______ %
e) Have Commercial Insurance? _______ %

18. What percentage, on average, do patients pay of the deductible or copayment bill you send them? (Please round to the nearest whole number.)

a) Deductible _______ %
b) Copayment _______ %

19. For your uninsured patients, what percentage of your usual fee do you collect for . . . (Please round to the nearest whole number.)

a) a routine office visit? _______ %
b) your most common surgical procedure (e.g. tonsillectomy) _______ %

20. For the last year:

a) What was the total dollar value of third-party reimbursement denials or fee reductions (approximately)? $ _______.
b) What percentage of your total third-party billings was this? _______ %

SUPPLEMENT (For MDs and DOs in general/family practice, internal medicine, and cardiology)

PLEASE PRINT OR TYPE BCBSM Provider Number: ________________

Physician Name: ____

****

1. During the last month, how many visits did you make to a skilled nursing facility or other nursing home? _______ visits. (If 0, go to Q. 6.)

   a) On average, about how many minutes at the home were required per patient visit (excluding travel time)? _______ minutes.

2. Do you regularly see nursing home patients at a site other than the nursing home?

   /_/ yes. What is the usual site of treatment? (Check appropriate box(es))

      /_/ 1. Hospital Outpatient Department;
      /_/ 2. Hospital Emergency Room; and/or
      /_/ 3. Your Office

   /_/ no.

3. How long (in minutes) does it usually take you to drive from the office or hospital to the nursing home? _______ minutes.

4. Are you formally affiliated with a nursing home?

   /_/ yes. Please check below:

      /_/ 1. Medical Director
      /_/ 2. Member, Organized Medical Staff
      /_/ 3. Owner, Co-Owner, Investor
      /_/ 4. Other: ____________________

   /_/ no.

5. What percentage of your patients have dual Medicare-Medicaid coverage?

   _______%

   a) Does dual coverage of patients discourage you from seeing nursing home patients?

      /_/ yes /_/ no

ANSWER QUESTIONS 6 & 7 ONLY IF YOU MADE NO VISITS TO A NURSING HOME DURING THE PAST MONTH.

6. What would you do in the event that one of your regular patients required admission to a nursing home? (Check appropriate box)

   /_/ 1. Make exception and continue to treat
   /_/ 2. Refer to another physician
   /_/ 3. Other (Please specify) ______________________________

7. In your decision not to visit nursing homes which of the following factors are important or not important?

	Very Important		Somewhat Important		Not Important
a) Reimbursement rates too low	/_/		/_/		/_/
b) Excessive paperwork associated with claims	/_/	OR	/_/	OR	/_/
c) Delays in receiving payments	/_/		/_/		/_/
d) Dislike general clientele found in nursing homes	/_/		/_/		/_/
e) No nursing home close to office	/_/		/_/		/_/
f) Few nursing home patients in practice	/_/		/_/		/_/
g) Other reason: ____________________	/_/		/_/		/_/

Table F.1

RESPONSE RATE PER QUESTION (BY MARKET AREA)

Market Area	Q.1 Accept New Patient	Q.2 Weekend Hours	Q.3 Phone Consults	Q.4 Solo Or Group Practice	Q.5 Foreign Medical Graduate	Q.6 Medical School Graduation	Q.7 Board Certification	Q.8 Specialty of Services Delivered
Oakland (Pontiac)	97%	96%	96%	98%	98%	95%	98%	99%
Grand Traverse (Traverse City)	98	96	96	98	100	100	100	100
Ingham (Lansing)	97	97	97	99	98	95	98	98
Washtenaw (Ann Arbor)	95	95	97	97	99	98	99	99
Wayne (Detroit)	95	95	94	98	98	97	98	98
Muskegon (Muskegon)	100	97	100	100	100	100	100	100
Kalamazoo (Kalamazoo)	98	98	97	99	100	96	100	100
Genesee (Flint)	95	98	95	99	98	96	98	98
Emmett (Petoskey)	97	97	97	97	97	94	97	100
Berrien (St. Joseph)	100	96	100	100	100	96	96	100
Kent (Grand Rapids)	97	96	94	97	99	97	96	98
Saginaw (Saginaw)	98	97	93	97	100	96	99	98
Macomb (Mt. Clemens)	98	95	95	95	97	93	98	98
Marquette (Marquette)	100	98	98	100	100	100	98	100
Bay (Bay City)	100	100	98	100	100	100	100	100
Michigan Total	96%	96%	95%	98%	98%	96%	98%	98%

Table F.1 (cont'd)

Q.9 Medical School Faculty	Q.10a Weekly Office Patients	Q.10b Weekly Office Hours	Q.10c Hospital Inpatient Visits	Q.10d Nursing Home Visits	Q.10e House Calls	Q.10f Hospital E.R. Visits	Q.10g Outpatient Clinic Visits	Q.11 Total Hours Seeing Patients
98%	96%	95%	95%	40%	94%	94%	92%	92 %
98	95	95	89	52	93	91	84	95
97	96	96	95	38	95	96	92	91
99	97	97	95	34	94	95	93	93
98	95	94	93	47	92	91	89	90
100	97	97	85	62	95	92	95	92
99	99	96	97	47	96	97	93	93
98	95	95	93	44	92	94	89	91
97	97	97	94	50	97	97	84	94
100	96	100	93	36	96	93	96	96
92	93	92	89	42	90	91	89	86
99	95	94	93	50	96	95	93	90
95	96	94	92	50	93	94	90	88
98	93	95	91	48	95	95	86	93
98	100	100	100	54	98	100	93	91
97%	95%	95%	93%	45%	93%	93%	90%	90 %

Table F.1 (cont'd)

------Waiting Days:---------				-----Number Employees-----			
Q.12a	Q.12b	Q.13	Q.14	Q.15a	Q.15b	Q.15c	Q.15d
Old Regular Patients	New Patients	Waiting Time - Scheduled Appointment	Travel Time	Clerical	R.N.s	Technicians	LPNs
92%	91%	91%	90%	81%	35%	48%	3%
89	82	89	95	79	38	34	16
94	90	93	92	73	51	23	11
89	85	91	89	75	39	24	2
89	86	89	90	75	32	41	4
92	87	92	90	87	62	33	8
88	87	89	87	76	51	34	7
91	89	93	91	81	40	37	9
97	94	97	94	81	47	38	13
86	79	96	93	93	32	39	--
90	88	91	91	80	44	29	15
91	87	90	93	84	50	29	9
89	88	87	89	77	32	41	5
98	93	91	98	84	59	36	18
96	96	98	98	93	61	39	7
90%	88%	90%	90%	78%	40%	37%	7%

Table F.1 (cont'd)

Weekly Wages:					Insurance				
Q.15e Clerical	Q.15f R.N.s	Q.15g Technicians	Q.15h LPNs	Q.16 Examining Rooms	Q.17a No. Insurance	Q.17b Blue Shield	Q.17c Medicaid	Q.17d Medicare Part B	Q.17e Commercial Insurance
54%	16%	28%	1%	91%	84%	87%	84%	80%	84%
52	23	20	7	95	82	82	84	79	80
49	29	13	5	90	79	80	75	68	76
48	22	11	1	90	79	81	77	71	77
48	14	22	1	90	80	84	83	78	81
67	38	18	8	97	79	79	82	72	79
51	34	22	2	91	77	78	79	69	78
53	19	21	3	94	87	89	89	81	82
47	25	22	6	91	72	78	75	72	75
46	11	18	--	86	82	79	82	71	82
48	23	15	9	90	75	74	75	69	73
50	23	15	9	90	75	74	75	69	73
48	13	21	1	89	79	81	80	75	77
57	34	14	9	98	82	84	82	80	86
61	35	15	4	98	85	85	89	83	85
50%	20%	20%	3%	91%	80%	82%	81%	76%	80%

Table F.1 (cont'd)

---------Patients Pay:---------		----Uninsured Patients Pay:----			
Q.18a Deductible	Q.18b Copay	Q.19a Office Visit	Q.19b Surgical Procedure	Q.20a $ Dental	Q.20b % Dental
65%	56%	77%	39%	29%	29%
68	66	80	50	38	38
45	42	71	42	30	30
55	52	74	39	37	37
57	53	75	38	34	34
46	38	74	51	26	28
51	49	74	43	25	25
60	56	75	47	28	28
50	47	66	50	28	28
68	64	89	54	29	29
50	49	72	50	21	21
56	52	70	44	26	26
62	59	80	44	31	31
73	68	86	55	36	36
63	59	87	76	43	43
57%	53%	75%	42%	30%	30%

Table F.2

DISTRIBUTION OF RESPONSE BY SPECIALTY AND BY MARKET AREA

Market Area	GP & FP	IM	Ped.	OB/GYN	G.S.	Other Med.	Other Surg.	Misc.	No Spec. Selected	Michigan Total
Oakland (Pontiac)	12.6%	27.4%	0.0%	25.2%	13.2%	28.2%	25.0%	26.8%	16.8%	20.7%
Grand Traverse (Traverse City)	3.9	2.1	0.0	1.7	2.4	0.7	3.6	1.9	0.0	2.6
Ingham (Lansing)	5.1	6.2	0.0	4.3	5.6	11.1	6.1	4.1	5.6	5.6
Washtenaw (Ann Arbor)	5.3	6.2	0.0	6.8	2.8	5.9	6.5	17.5	5.6	7.1
Wayne (Detroit)	23.4	23.5	0.0	22.2	23.9	15.6	15.3	17.5	19.4	21.1
Muskegon (Muskegon)	2.8	1.8	0.0	0.9	2.4	0.0	2.0	1.0	0.0	1.8
Kalamazoo (Kalamazoo)	6.9	6.5	0.0	8.1	6.1	7.4	5.6	4.5	0.0	6.3
Genesee (Flint)	7.0	3.8	100.0	4.3	9.4	7.4	6.1	5.6	5.6	6.2
Emmet (Petoskey)	1.9	0.6	0.0	0.9	3.8	1.5	1.6	0.7	0.0	1.5
Berrien (St. Joseph)	0.9	0.9	0.0	2.6	0.9	1.5	2.0	1.5	0.0	1.3
Kent (Grand Rapids)	10.3	5.9	0.0	13.3	9.9	5.9	11.3	8.2	11.1	9.4
Saginaw (Saginaw)	7.3	2.9	0.0	1.3	5.6	1.5	5.2	4.5	5.6	4.8
Macomb (Mt. Clemens)	5.8	7.7	0.0	6.8	7.0	10.4	5.2	3.7	5.6	6.3
Marquette (Marquette)	3.0	1.8	0.0	0.9	3.3	0.7	1.6	1.9	0.0	2.1
Bay (Bay City)	3.3	1.8	0.0	0.9	3.8	0.7	2.4	0.7	0.0	2.2
Michigan Totals	30.3%	16.1%	0.1%	11.1%	10.1%	6.4%	11.7%	12.7%	1.7%	100.0%

Table F.2A

NUMBER IN SPECIALTY CATEGORY BY MARKET AREA

Market Area	GP & FP	IM	Ped.	OB/GYN	G.S.	Other Med.	Other Surg.	Misc.	No Spec. Selected	Michigan Total
Oakland (Pontiac)	81	93	0	59	28	38	62	72	6	439
Grand Traverse (Traverse City)	25	7	0	4	5	1	9	5	0	56
Ingham (Lansing)	33	21	0	10	12	15	15	11	2	119
Washtenaw (Ann Arbor)	34	21	0	16	6	8	16	47	2	150
Wayne (Detroit)	150	80	0	52	51	21	38	47	7	446
Muskegon (Muskegon)	18	6	0	2	5	0	5	3	0	39
Kalamazoo (Kalamazoo)	44	22	0	19	13	10	14	12	0	134
Genesee (Flint)	45	13	1	10	20	10	15	15	2	131
Emmett (Petoskey)	12	2	0	2	8	2	4	2	0	32
Berrien (St. Joseph)	6	3	0	6	2	2	5	4	0	28
Kent (Grand Rapids)	66	20	0	31	21	8	28	22	4	200
Saginaw (Saginaw)	47	10	0	3	12	2	13	12	2	101
Macomb (Mt. Clemens)	37	26	0	16	15	14	13	10	2	133
Marquette (Marquette)	19	6	0	2	7	1	4	5	0	11
Bay (Bay City)	21	6	0	2	8	1	6	2	0	46
No Area Specified	4	4	0	0	0	2	1	0	9	20
Michigan Totals	642	340	1	234	213	135	248	269	36	2,118

Table F.3

ACCESS TO PHYSICIAN CARE (BY MARKET AREA)

Rank	Market Area	Physician Pop/100,000	% Accepting New Patients	% Working Weekend Hours	Average # Phone Consults	Nursing Home and House Call Visits	---Waiting Times:---- Old Patients	New Patients	% Travel Time ½ Hour +
1	Oakland (Pontiac)	225.9	75%	46%	8.5	2.2	3.6	5.9	21.8%
2	Grand Traverse (Traverse City)	216.6	75	35	7.7	6.0	4.4	4.7	32.1
3	Ingham (Lansing)	150.4	63	26	6.8	1.0	4.7	8.5	22.0
4	Washtenaw (Ann Arbor)	145.7	56	41	6.0	1.3	6.2	9.5	18.0
5	Wayne (Detroit)	132.4	67	42	7.9	1.8	3.2	6.1	23.9
6	Muskegon (Muskegon)	124.1	59	34	7.6	2.8	4.1	9.9	8.6
7	Kalamazoo (Kalamazoo)	120.3	56	31	8.1	2.0	6.4	10.4	10.3
8	Genesee (Flint)	118.9	63	26	8.7	1.5	3.1	4.9	16.0
9	Emmett (Petoskey)	112.9	87	35	7.1	6.4	7.3	9.2	40.0
10	Berrien (St. Joseph)	109.2	64	30	6.5	6.0	4.9	9.6	7.7
11	Kent (Grand Rapids)	107.6	68	34	7.9	3.8	5.2	8.7	19.2
12	Saginaw (Saginaw)	103.0	71	42	8.4	3.3	3.3	6.3	28.7
13	Macomb (Mt. Clemens)	99.7	72	39	8.1	1.6	3.3	4.7	15.3
14	Marquette (Marquette)	93.0	74	33	7.2	3.6	2.8	5.6	30.2
15	Bay (Bay City)	85.1	59	30	7.3	1.1	6.1	9.8	26.7
	Michigan Totals	133.8	68%	38%	7.8	2.3	4.2	7.0	20.9%

Table F.3A

ACCESS TO PHYSICIAN CARE (BY SELECTED SPECIALTIES AND GROUPED MARKET AREAS)

Specialty Categories:	Accept New Patients	Average Weekend Hours	Phone Consults	Nursing Home & House Call Visits	----Waiting Times----- Old Patients	New Patients	% Travel Time Over ½ Hour
GP and FP	68.2%	2.9	8.9	5.3	1.3 days	2.0 days	14.4%
Internal Medicine	62.3	1.2	8.4	2.0	2.8	7.4	20.8
General Surgery (GS)	81.0	1.0	6.1	1.4	2.2	2.8	18.4
Michigan Average	69.0%	1.8	8.0	3.1	2.1	4.2	17.8%
MD/Pop Grouped Market Areas:							
Low	67.9%	1.6	7.8	1.9	3.8	6.0	20.9%
Low - Medium	68.1	1.5	8.1	3.1	4.4	7.3	21.1
High - Medium	62.7	1.5	7.4	1.7	4.4	7.8	20.6
High	74.6	2.4	8.4	2.6	3.7	5.8	23.0
Michigan Average	67.3%	1.7	7.9	2.2	4.2	7.0	21.3%

Table F.4

PRACTICE AMENITIES (BY MARKET AREA)

Market Area	Physician Pop/100,000	Length of Office Visit	Exam Rooms Per Visit	Office Room Wait	Wage Bill Per Visit
Oakland (Pontiac)	225.9	21 min.	0.045	17 min.	$3.17
Grand Traverse (Traverse City)	216.6	18	0.037	18	2.26
Ingham (Lansing)	150.4	19	0.053	15	3.87
Washtenaw (Ann Arbor)	145.7	23	0.033	11	3.16
Wayne (Detroit)	132.4	19	0.043	19	2.52
Muskegon (Muskegon)	124.1	20	0.056	21	2.74
Kalamazoo (Kalamazoo)	120.3	15	0.035	16	2.42
Genesee (Flint)	118.9	16	0.033	17	2.26
Emmett (Petoskey)	112.9	19	0.035	19	1.19
Berrien (St. Joseph)	109.2	15	0.027	17	1.03
Kent (Grand Rapids)	107.6	17	0.041	17	2.56
Saginaw (Saginaw)	103.0	16	0.038	19	2.08
Macomb (Mt. Clemens)	99.7	16	0.039	21	1.77
Marquette (Marquette)	93.0	18	0.041	18	2.42
Bay (Bay City)	85.1	16	0.038	21	1.88
Michigan Total	133.8	18 min.	0.041	18 min.	$2.62

Table F.4A

PRACTICE AMENITIES (BY SELECTED SPECIALTIES AND GROUPED MARKET AREAS)

Specialty Categories:	Length of Office Visit	Exam Rooms Per Visit	Office Room Wait	Wage Bill Per Visit
GP and FP	20 min.	0.046	20 min.	$1.76
IM	27	0.073	19	2.98
GS	20	0.083	18	2.33
Michigan Average	23 min.	0.065	19 min.	$2.36
MD/Pop Grouped Market Areas:				
Low	21 min.	0.061	20 min.	$1.92
Low - Medium	21	0.061	18	2.20
High - Medium	28	0.076	17	2.81
High	30	0.072	17	3.07
Michigan Average	26 min.	0.070	18 min.	$2.63

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Table F.5

PHYSICIAN CHARACTERISTICS BY MARKET AREA

Market Area	Physician Pop./100,000	% - Foreign Medical Grad.	Years of Experience	% Board Certified	% Faculty Members	% in Group Practice
Oakland (Pontiac)	225.9	21%	20	72.2%	31%	34%
Grand Traverse (Traverse City)	216.6	5	17	53.6	13	35
Ingham (Lansing)	150.4	5	22	75.2	61	47
Washtenaw (Ann Arbor)	145.7	15	18	66.2	41	27
Wayne (Detroit)	132.4	23	24	58.0	28	33
Muskegon (Muskegon)	124.1	5	18	74.4	6	31
Kalamazoo (Kalamazoo)	120.3	13	23	65.7	28	35
Genesee (Flint)	118.9	22	23	58.9	43	22
Emmett (Petoskey)	112.9	3	18	54.8	13	48
Berrien (St. Joseph)	109.2	32	25	59.3	4	39
Kent (Grand Rapids)	107.6	7	20	63.0	44	47
Saginaw (Saginaw)	103.0	16	24	66.0	36	24
Macomb (Mt. Clemens)	99.7	26	21	66.4	26	33
Marquette (Marquette)	93.0	7	18	67.4	25	27
Bay (Bay City)	85.1	17	21	45.7	4	24
MICHIGAN TOTAL	133.8	17%	22	64.5%	32%	34%

Table F.6

INSURANCE COVERAGE BY MARKET AREA

Market Area	Physician Pop/100,000	Percent of Patients With: No Ins.	Blue Shield	Medicaid	Medicare Part B	Comm. Ins.	Patients Pay: % Ded.	% Copay	Uninsured Patients Pay: % Office Visit	% Surgical Procedure	% Denials
Oakland (Pontiac)	225.9	8.2%	54.1%	11.2%	22.3%	18.6%	66.7%	66.8%	87.4%	80.4%	25.2%
Grand Traverse (Traverse City)	216.6	11.5	33.1	23.1	28.3	25.4	79.0	79.7	89.4	83.2	26.3
Ingham (Lansing)	150.4	8.1	39.2	15.4	21.2	28.4	79.4	72.5	84.7	74.2	25.4
Washtenaw (Ann Arbor)	145.7	8.6	48.5	10.6	20.0	24.6	73.0	70.1	89.4	75.8	24.5
Wayne (Detroit)	132.4	7.9	51.0	19.7	25.0	14.4	51.9	51.4	81.7	70.0	29.7
Muskegon (Muskegon)	124.1	9.5	22.3	21.7	28.7	31.7	81.4	77.1	86.0	83.9	31.5
Kalamazoo (Kalamazoo)	120.3	9.1	26.8	17.0	28.2	34.0	81.1	79.0	88.0	80.1	18.9
Genesee (Flint)	118.9	7.3	60.8	14.0	23.2	12.2	66.9	64.0	88.2	82.0	24.6
Emmett (Petoskey)	112.9	11.0	29.4	24.5	32.7	18.9	78.4	78.0	89.5	81.6	32.7
Berrien (St. Joseph)	109.2	7.1	19.4	24.6	21.6	37.0	77.4	77.5	92.5	83.9	23.0
Kent (Grand Rapids)	107.6	9.6	30.7	18.9	24.2	32.0	75.3	72.9	90.1	88.4	18.4
Saginaw (Saginaw)	103.0	8.5	41.5	18.6	24.3	23.0	67.3	67.4	77.0	83.0	27.6
Macomb (Mt. Clemens)	99.7	5.7	57.8	12.0	36.4	16.9	52.4	53.6	85.8	72.5	21.7
Marquette (Marquette)	93.0	14.1	20.4	19.1	31.6	30.4	83.3	74.1	90.4	84.9	33.7
Bay (Bay City)	85.1	7.8	42.1	19.7	26.4	19.9	72.0	76.5	93.1	63.2	21.6
Michigan Totals	133.8	8.3%	45.7%	16.2%	25.1%	21.4%	66.5%	65.4%	86.8%	79.0%	25.7%

Table F.7

PHYSICIAN WORKLOAD BY MARKET AREA

		Average Weekly Visits By Location:						Average Weekly Hours:		
Market Area	Physician Pop/100,000	Office	Hospital I/P	Nursing Home	House Calls	Hospital E.R.	O/P Clinic	Office	Total	Average Weekend Hours
Oakland (Pontiac)	225.9	76	23	1.68	0.51	1.9	1.1	26.7	42.9	2.5
Grand Traverse (Traverse City)	216.6	91	29	5.28	0.71	7.8	3.0	26.5	44.8	1.1
Ingham (Lansing)	150.4	66	25	0.55	0.46	2.0	1.9	21.1	36.7	0.8
Washtenaw (Ann Arbor)	145.7	66	18	0.59	0.66	1.7	1.1	25.9	39.4	1.3
Wayne (Detroit)	132.4	82	23	0.84	0.96	1.6	1.3	25.9	40.9	2.0
Muskegon (Muskegon)	124.1	82	31	2.56	0.22	7.5	0.1	27.4	50.6	1.6
Kalamazoo (Kalamazoo)	120.3	101	31	1.68	0.36	3.6	0.9	26.5	48.7	1.0
Genesee (Flint)	118.9	92	27	1.20	0.32	2.6	1.8	25.2	41.2	1.5
Emmett (Petoskey)	112.9	90	33	1.26	5.16	5.1	3.3	28.8	50.5	2.1
Berrien (St. Joseph)	109.2	122	23	5.86	0.11	1.7	0.1	29.2	45.5	1.2
Kent (Grand Rapids)	107.6	89	28	2.61	0.47	3.5	1.0	24.7	26.1	0.9
Saginaw (Saginaw)	103.0	100	31	2.65	0.64	5.4	3.6	26.3	42.6	2.4
Macomb (Mt. Clemens)	99.7	92	28	1.22	0.40	2.2	1.1	25.6	44.0	1.9
Marquette (Marquette)	93.0	88	31	3.17	0.45	6.1	1.8	25.2	45.0	1.0
Bay (Bay City)	85.1	98	41	0.67	0.44	5.5	2.2	26.7	48.3	1.4
Michigan Totals	133.8	84	26	1.61	0.65	2.8	1.4	25.8	42.4	1.7

APPENDIX G

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APPENDIX G

CREATION OF A HEALTH STATUS INDEX

A health status index was created to estimate variations in illness severity across Michigan. This index measures the extent of confounding diagnoses and was calculated as the ratio of predicted total charges per beneficiary to the actual statewide average for total charges within each diagnostic tracer. By regressing total charges per beneficiary on a set of exogenous variables, we are able to construct predicted total charges in the first stage, then scale each beneficiary's predicted value by the statewide average in a second stage.

First, we regress actual 1980 Medicare charges for each beneficiary in the tracer on diagnoses, age, and sex:

$$CHARGE_i = f_i\ (DX_k,\ AGE,\ SEX)$$

where

$CHARGE_i$ = Total charges per beneficiary in the i-th tracer;

DX_k = Vector of dummy variables representing k secondary diagnoses;

AGE = Beneficiary's age; and

SEX = Beneficiary's sex.

This gives the following predicted charge equation:

$$PCHARGE = \sum_k \hat{a}_k \cdot DX_k + \hat{b} \cdot AGE + \hat{c} \cdot SEX$$

where a, b, and c are estimated regression coefficients that are constant across all beneficiaries in all market areas. Last, a health status index (HSI_i) for the i-th tracer is defined as

$$HSI_{ia} = \frac{\sum_m PCHARGE_{mia}}{MCHARGE_{state}}$$

where the numerator is the sum of predicted charges for all m beneficiaries in the a-th market area for the i-th tracer, and the denominator is the mean tracer charge in the state.

Even though charges are used to estimate the price equation, note that no market specific differences in medical care charges or utilization patterns figure into the index's calculation. This is because constant weights are being applied to all beneficiaries' diagnostic and demographic characteristics. Thus, interarea variations in the index will be due solely to variations (if any) in the mix of confounding diagnoses, age, and sex of the population.

Table G.1 provides variable definitions for the charge regression. The presence of confounding diagnoses, together with the beneficiary's age and sex will be reflected in varying predicted charges.

Means for components of the charge equation appear in Table G.2. We find mean total charges per beneficiary in 1980 for all medical care equal to \$668.39, \$737.53 and \$944.16 for hypertension, diabetes, and UTI, respectively. They form the denominators of our health status index. Sixteen percent of those in the hypertension sample also were diagnosed as having diabetes while thirteen percent of the UTI patients had diabetes as a confounding diagnosis. Hypertension represented a complicating diagnosis in 23 percent of the diabetes patients and 21 percent of those in the UTI

tracer file. Other major confounding diagnoses include ANEMIA, CIHD, RESP, and OTHER. For example, 11 percent of the hypertension patients had anemia, chronic ischemic heart disease, or bronchitis. The average age in all three tracer groups was 73 years while 34-38 percent of those in each tracer group were males.

Regression results are presented in Table G.3. The presence of secondary diagnoses adds significantly to total charges in all tracers with the exception being endocrine system disorders (ENDOC) and back or muscular disorders (Musculo) for diabetic and UTI patients. A hypertension patient can add as much as $1,612.53 to his total annual bills with the presence of an acute myocardial infarction ($621.23), arthereosclerosis ($445.71), and pneumonia ($545.59) as complicating diagnoses.

One drawback to the analysis involves the limitation in the number of secondary diagnoses reported. Only three confounding illnesses per beneficiary were taken from the Medicare claims data. Thus, predicted charges may be understated in particular cases where patients have secondary diagnoses in excess of the three recorded. This should not result in any interarea bias, however.

Table G.4 presents health status indices aggregated to the market area level for the three tracer groups. A value of 1.00 indicates that the average health status of beneficiaries in a particular market area does not differ from the statewide average. Market areas with index values less than one have beneficiaries with fewer confounding diagnoses, and are therefore considered healthier on average. Six market areas exhibit indices less than one for all three tracer groups: Grand Traverse, Ingham, Washtenaw, Kalamazoo, Kent and Marquette. Beneficiaries having total predicted charges greater than the statewide average, i.e., have an index greater than one are viewed as being sicker. Areas with a uniformly sicker population include: Oakland, Wayne, Genesee, Saginaw, Macomb and Bay.

TABLE G.1

VARIABLE DEFINITIONS FOR PREDICTED CHARGE EQUATION

VARIABLE NAME	DEFINITION
PCHARGE	Predicted Total Charge per Beneficiary
HPN	1= Hypertension, 0 Otherwise
DM	1= Diabetes, 0 Otherwise
UTI	1= Urinary Tract Infection, 0 Otherwise
ENDOC	1= Endocrine System Disorders, 0 Otherwise
ANEMIA	1= Anemia, 0 Otherwise
MYOCARD	1= Acute Myocardial Infarction, 0 Otherwise
HEART	1= Hypertensive Heart Disease, 0 Otherwise
VASCULAR	1= Arthereosclerosis, 0 Otherwise
CIHD	1= Chronic Ischemic Heart Disease, 0 Otherwise
HRTSYMP	1= Heart Disease Symptoms, 0 Otherwise
RESP	1= Bronchitis, Other Respiratory Problems, (0, Otherwise)
PNEUM	1= Pneumonia, 0 Otherwise
DIGEST	1= Liver, Digestive Disorders, 0 Otherwise
GENUTI	1= Kidney and General Urinary Problems, (0, Otherwise)
ARTH	1= Arthritis, 0 Otherwise
MUSCULO	1= Back Disorders & Muscular Symptoms, (0, Otherwise)
OTHER	1= Other Problems, 0 Otherwise
SEX	1= Male, 0 = Female
AGE	1= Beneficiary's Age

TABLE G.2

MEANS FOR DIAGNOSTIC TRACER PREDICTED TOTAL CHARGE EQUATIONS

	Diagnostic Tracers		
Variables	**Hypertension**	**Diabetes**	**UTI**
PCHARGE	$ 668.39	$ 737.53	$ 944.16
HPN	------	0.23	0.21
DM	0.16	------	0.13
UTI	0.03	0.04	
ENDOC	0.05	0.05	0.04
ANEMIA	0.11	0.13	0.14
MYOCARD	0.02	0.02	0.02
HEART	0.09	0.10	0.10
VASCULAR	0.03	0.04	0.04
CIHD	0.11	0.12	0.10
HRTSYMP	0.06	0.06	0.07
RESP	0.11	0.09	0.12
PNEUM	0.02	0.03	0.03
DIGEST	0.02	0.02	0.04
GENUTI	0.08	0.08	0.26
ARTH	0.08	0.07	0.08
MUSCULO	0.02	0.02	0.02
OTHER	0.12	0.11	0.13
SEX (MALE)	34.8	38.0	38.2
AGE	73.6	73.4	73.2

TABLE G.3

REGRESSION RESULTS FOR PREDICTED TOTAL CHARGES

DIAGNOSTIC TRACERS

Variables	Hypertension		Diabetes		Urinary Tract Infection	
CONSTANT	371.63	(5.4)	857.41	(11.3)	836.33	(8.2)
HPN	------		- 32.95	(1.5)	- 6.41	(0.2)
DM	116.83	(5.7)	-----		116.39	(2.7)
UTI	130.09	(3.1)	81.69	(1.7)		
ENDOC	- 18.63	(0.5)	- 86.03	(2.1)	- 39.84	(0.5)
ANEMIA	78.00	(3.2)	77.42	(2.9)	62.49	(1.5)
MYOCARD	621.23	(11.6)	494.50	(8.3)	687.66	(6.7)
HEART	335.30	(12.6)	330.18	(10.8)	340.33	(7.0)
VASCULAR	445.71	(10.7)	454.33	(9.8)	329.36	(4.3)
CIHD	386.37	(15.8)	333.50	(12.0)	405.24	(8.6)
HRTSYMP	320.93	(10.0)	440.07	(11.4)	405.05	(7.1)
RESP	290.41	(11.8)	317.53	(10.3)	152.89	(3.4)
PNEUM	545.59	(10.9)	399.08	(7.1)	691.73	(8.3)
DIGEST	160.22	(3.0)	121.34	(2.0)	- 19.50	(0.3)
GENUTI	307.99	(11.0)	304.57	(9.2)	95.89	(2.8)
ARTH	242.80	(8.5)	235.34	(6.5)	266.91	(5.1)
MUSCULO	42.93	(0.8)	285.89	(4.0)	71.68	(0.6)
OTHER	295.24	(12.8)	313.26	(10.9)	285.50	(6.7)
SEX	83.49	(5.2)	58.62	(3.2)	142.50	(4.8)
AGE	- 0.11	(0.1)	- 5.32	(5.3)	- 3.02	(2.2)
R^2	0.09		0.07		0.07	
F	71.83		52.90		21.90	
(df)	(19, 13420)		(19, 12220)		(19, 5657)	

(t statistics in parenthesis)

TABLE G.4

HEALTH STATUS INDEX BY MARKET AREA

Market Area	Tracers DM	Tracers HPN	Tracers UTI
Oakland (Pontiac)	1.01	1.05	1.01
Grand Traverse (Traverse City)	0.97	0.95	0.99
Ingham (Lansing)	0.97	0.96	0.97
Washtenaw (Ann Arbor)	0.97	0.97	0.95
Wayne (Detroit)	1.02	1.03	1.03
Muskegon (Muskegon)	1.02	0.99	1.00
Kalamazoo (Kalamazoo)	0.97	0.96	0.95
Genesee (Flint)	1.00	1.04	1.04
Emmett (Petoskey)	1.04	0.98	0.97
Berrien (St. Joseph)	1.01	0.97	0.93
Kent (Grand Rapids)	0.97	0.96	0.95
Saginaw (Saginaw)	1.00	1.03	1.02
Macomb (Mt. Clemens)	1.04	1.03	1.04
Marquette (Marquette)	0.92	0.89	0.90
Bay (Bay City)	1.04	1.02	1.00

Note: A higher index value implies a sicker beneficiary population.